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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 3, 1863.

STEAM FIRE-ENGINES.

It is difficult to imagine anything more likely to interest the population of a large city than the means of extinguishing fires. The vast destruction of property, the fearful peril to life and limb, the misfortune and misery which attend an extensive conflagration, all tend to place such events in the first rank as fearful calamities. It is a little strange, then to find, that the number of inventions for machines intended to extinguish fires—or fire-engines, in fact—is very small, and that, almost without exception, patents for such contrivances have all been taken out within a very few years. It would be a mere waste of time to discuss the causes which have led to this sufficiently remarkable result; perhaps it arose from the necessity of employing very simple machinery, which afforded little or no scope for that inventive faculty which impels individuals to the Patent-office; perhaps, because the employment, and purchase of such machinery, rests with particular individuals or companies, not with the general public. Suffice it to say, that until within the last thirty or forty years, very little indeed has been done towards supplying cities, ships, or public buildings with trustworthy machines capable of throwing a quantity of water, large enough to be useful, on burning materials.

Nevertheless, the invention, or rather the application, of forcing pumps to the extinguishing of fires, dates back as far as the year 1518, when the existence at Augsburg of a machine of the kind is mentioned. Schott, a Jesuit, describes an engine constructed at Nuremburg in 1657. It was placed on a sledge, drawn by two horses; and, when worked by twenty-eight men, threw an inch jet 80 ft. high. We find the first mention of an air vessel about the year 1699. Leather hose was introduced by Van der Heyden, of Amsterdam, about 1670.

It is very difficult to determine accurately the date of the first employment of any of these machines in London, nor is it indeed a matter of any moment. We may reasonably presume that they were introduced here very soon after their invention on the Continent. All the rest is hidden by the veil of time. About a century ago Mr. Newsham was the principal London builder, and during the last century the fire-engine met with slow improvement from different hands, until about thirty years ago, when Mr. Braithwaite constructed the first steam fire-engine of which we have any record. From the stimulus thereby given to the subject, and the attention it received, the very happiest results have followed; and the fire-engine, from being a miserable hand squirt, has become a magnificent steam pump, whose capacity for elevating water must be measured by the ton, rather than the gallon. Mr. Braithwaite's engine weighed about 6,000 lb. had an upright boiler of about 6-horse power, required twenty minutes to raise steam to a working pressure, and was capable of throwing 150 gallons per minute 80 to 90 ft. high, the steam and water pistons on the same rod were respectively 7 in. and 6½ in. in diameter, with a 16 in. stroke.

But it most certainly is not to the Old World that we are to look for the most prominent records of improvement in this department of hydraulic engineering. Although England took the initiative, and produced the first steam fire-engine, America is entitled to much of the credit of developing the system. Nor is this to be wondered at, when we remember how much more prevalent fires are in the cities of the New World than here. The inflammable nature of the building materials employed, the intense heat of summer weather, and perhaps, a certain amount of recklessness and disregard of proper precautions, are all predisposing causes which conduce strongly enough to conflagrations which demand the employment of the most strenuous means for their extinction. Thus, steam fire-engine building has become as much a department of trade and engineering in North America, as the manufacture of locomotives has in England.

To enter at large into the history of steam fire-engines is foreign to our purpose; but examples of what they have accomplished during the last few years are interesting, as affording a means of comparison both with their present and future performances. The first credit for their successful construction in America, is doubtless, due to Mr. Latta, of Cincinnati, who turned out his first engine in 1853. This ponderous machine weighed not less than 12 tons, and required the tractive force of four horses to aid its progress, although styled a self-propeller. The boiler had a square fire-box, with a continuous coil of tubes in the upper part, through which the water was constantly driven by a circulating pump when the engine was in motion. The time ordinarily taken to get up steam was five to ten minutes, the coil of tube being kept empty till almost red hot, when the action of the circulating pump, by filling it with water, already nearly boiling from contact with the sides of the fire-box, quickly produced sufficient steam to start the engine. Subsequent engines, by the same maker, were considerably improved and reduced in weight; one of them, weighing 8 tons, is said to have thrown an 1½-in. jet 300 ft. horizontally.

At a grand trial of steam fire-engines which took place at Boston in August, 1858, four engines were entered for competition—the "Philadelphia," the "Lawrence," the "E. Smith," and the "New Era." The weight of these engines varied from 7,500 lb. to 9,500 lb.; the time of raising steam to 60 lb. from 10½ minutes to 18½ minutes; the quantity of water thrown by each was 306, 302½, 309, and 345 gallons per minute, to horizontal distances of 163, 155, 140, and 135 ft., and to vertical heights of 110, 110, 125, and 90 ft., the greatest steam pressure being limited to 120 lb. on the square inch. All these engines had upright tubular boilers and reciprocating pumps.

Silsbee and Co. introduced engines very different in construction and arrangement from anything we have in England. The boilers being horizontal, rectangular, and forming the bed-plate for the machinery, both the engine and pump are rotary, and in a certain sense without valves. The steam has been raised in 6 minutes, a small fan being employed to urge the fire; and the entire arrangement is considered very satisfactory in its results and practical working.

The pages of the MECHANICS' MAGAZINE have, from time to time, recorded every improvement which the fire-engine has received in England; a recapitulation of these facts is, therefore, unnecessary here; and the great trial which took place on Wednesday last at the Crystal Palace has proved, conclusively enough, that, so far at least, our English builders are quite capable of equalling, if not exceeding, anything which American enterprise has yet accomplished in this peculiar branch of steam engineering.

The trial took place, as our readers are perhaps aware, in the Crystal Palace grounds, near the north water temple, one of the broad flights of stone terrace steps supplying an admirable location for the engines, hose, hoods, &c.; the engines being placed on one of the landings, and the hoods and tanks on another higher up. The prizes offered were two of £250 each, and two of £100 each. The hoods were raised 40 ft. above the level of the engines, and at an horizontal distance of about 100 ft. The hoods were very similar to those employed last year in Hyde-park, delivering the water through canvas pipes into tanks below, each capable of containing 1,000 gallons.

Eight engines only competed for the prizes; the "Manhattan," which came over from New York, per "Great Eastern," having most unfortunately met with an accident, which resulted in the serious, if not fatal, injury of one of the men in charge, as well as effectually placing the engine *hors de combat* for Wednesday's trial at least. The circumstance is the more to be regretted, as the "Manhattan" is considered one of the "crack" American engines; and its trial would have, to a considerable extent, settled the question of relative merits between London and New York fire-engines.

The trial commenced with the fire-engines over 30 cwt. weight, built respectively by Mr. Roberts, of the firm of Brown, Lennox and Co., Millwall; Messrs. Merryweather, of Long Acre; Easton and Amos, Southwark; Shand and Mason, Blackfriars; and the Amoskeag Engine Building Company, U.S. Mr. Roberts' engine has vertical tubulous boiler, with fire tubes passing through the upper water-space, vertical steam cylinder 7 in. diameter, and 13 in. stroke, arranged somewhat on the "table" principle, the fly-wheel being, however, driven by a bell crank motion. The pump is 9½ in. diameter, with two pistons, which approach to and recede from each other, through the agency of a shaft passing right across the pump barrel, carrying links and arms arranged to give a stroke of 3¼ in. to each piston. The stroke of the pump being equivalent, consequently, to 6½ in. for a single piston. The distinguishing feature of this engine is its ability to carry almost every necessary at a fire—ladders, buckets, hand pipes, an immense quantity of hose, and 17 men—in consequence, although really, perhaps, entitled to be classed as a small engine, it was over the prescribed weight, and had to compete with a far more powerful class of machinery, in which, as might be expected, it failed.

Merryweather's engine has steam cylinders 8¾ in. diameter, arranged horizontally, facing two pumps 6½ in. diameter, the same rod being common to both pistons; stroke 24 in. The steam cylinders have piston valves worked by a very peculiar system of screwed rods, no fly-wheel being employed. The action is, in consequence, in some degree, irregular and unpleasant, but not to any serious extent: it injured the quality of the jet, however, rendering it at times fitful and scattered. The engine weighed, empty, about 2 tons 17 cwt.; vertical tubulous boiler.

Shand and Mason's engine has likewise two horizontal steam cylinders 8½ in. diameter, and two pumps, 7 in. diameter and 9 in. stroke, with piston-rods common to both. These rods have slotted cross-heads which give motion to a fly-wheel shaft running across the engine frame between the pumps and steam cylinders. The boiler is upright tubular, the shell formed of Low Moor, welded. The tubes less than an inch in diameter, and nearly 300 in number, are so arranged in groups as to leave four wide water-spaces to permit free circulation, the shell of the boiler can be easily

removed from the fire-box part, permitting easy access to the tubes. The motion was very easy, and the jet thrown extremely close and compact; weight of engine 2 tons 16 cwt.

Easton and Amos's engine has two 9½ horizontal steam cylinders, with 8½ in. stroke, with two sizes of pumps—one 5½ in., and the other 6½ in. in diameter. The arrangement of engine is precisely the same as that of the "Worthington" steam-pump exhibited in 1862, no fly-wheel being employed. The boiler is on the American principle, vertical, with an immense number of water-tubes suspended from the water-space at top. The weight of this engine 2 tons 18½ cwt. empty.

The Amoskeag engine has a nearly similar boiler, and one vertical steam cylinder 10½ in. diameter and 12 in. stroke; a 4 in. pump being placed exactly underneath and worked by the same rod, which has a slotted cross-head, giving motion to a fly-wheel shaft; weight of engine 2 tons 17 cwt. All these engines can play through more than one delivery hose at a time, although on Wednesday they confined themselves to a single jet.

The fires having been laid, the matches were applied by signal at about half-past twelve o'clock; the three English engines had steam in about four minutes, and immediately turned on their blowers. Merryweather had steam of the prescribed 100 lbs. first, raising it to that pressure in 10 min. 25 sec. from the application of the match. Mr. Roberts and Shand and Mason being scarcely a second behind. The American engine, from having no blower, was more tardy; not having 100 lb. steam until nearly seventeen minutes had elapsed; Easton and Amos taking nearly a quarter of an hour. The four larger engines made capital practice, filling their tanks in a surprisingly short time, the race proving as might be expected, very exciting. It was quickly evident that Mr. Roberts was quite over-matched—a fact not to be wondered at when we remember that his antagonists were nearly double his weight; nevertheless, his practice was exceedingly good, his engine working very steadily, and the jet thrown, close and compact. Every precaution was taken to prevent the spray from a jet entering any hood into which another was playing, and the breeze was so slight as not materially to affect the results.

Three engines entered in the light class (under 30 cwt.), the competitors being Messrs. Shand and Mason, Merryweather, and Lee; Shand and Mason's engine has a boiler exactly similar in construction to, but smaller than that already described; the engine and pump are arranged at the back of the boiler, leaving space for a hose reel, &c., in front, accommodation for several men being provided as well. The frame is formed of steel tubes about 5 in. in diameter, in which the firing tools, stand pipes, &c. are conveniently carried. The steam cylinder is 7 in. in diameter, vertical; with an 8 in. stroke. The piston is hollow, weighing only 8 lbs., and has two steel piston rods, giving motion to a pump of the variety known as bucket and plunger; the barrel being 9 in. in diameter with a 6½ in. plunger; within this last descends a connecting rod which gives motion to a fly-wheel shaft. There are many minor points of interest about this engine which we may perhaps refer to again.

Merryweather's engine has one horizontal cylinder working one pump with the same rod: diameter of steam cylinder, 6½ in.; of pump, 4½; stroke, 12 in.; no fly-wheel; the boiler, upright, water tube.

Lee's engine, built by the Amoskeag Company, is precisely the same in every respect but size as the larger one we have already described—weight 30 cwt.; steam piston, 8½ in.; pump piston, 6½ in.; stroke, 12 in. The jets thrown by all the engines were very good, Messrs. Shand and Mason eclipsing all competitors, however, their jet being distinguished by a closeness which carried the water clear into the hood with a shock which threatened its stability.

Subsequently, Messrs. Easton's engine attempted the 18 ft. lift, and, having failed in two attempts, the fires were drawn, and the proceedings terminated for the day.

Some exception has from time to time been taken against the use of hoods as a test in such trials. We, however, imagine that the real question is not the quantity of water which an engine can pass through it, but rather the quantity which it can lodge in a given time in the right place. Any water which finds its way elsewhere must be a positive evil; and we cannot question that that engine which throws a solid condensed stream, be it only 300 gallons per minute, must be far more effectual, and answer the purpose much better, than an engine throwing twice the quantity by fits and starts, by which it is half-wasted in spray.

Yesterday, the experiments were continued, and, instead of the engines endeavouring to fill tanks of 1,000 gallons simultaneously, the competition consisted, in which engine could fill a tank of 18,000 gallons in the shortest space of time. The "Sabrina," after several ineffectual attempts under the superintendence of Messrs. Easton and Amos, had to be withdrawn. Shand and Mason's engine filled the tank in exactly two hours. Messrs. Merryweather's engine executed the same task in rather less than one hour and a-half, the two stoppages arising from the hose twice bursting included. The last engine experimented on, Lee's "Victoria," commenced most favourably, throwing more water than any of its competitors during the time it was at work; but, owing to an unfortunate accident—the breakage of the cylinder lid—it had to be withdrawn ere the tank was half-full.

The "Manhattan," in a convalescent state, mounted, on a perfect American bogie, exhibited its capacity by throwing vertical and horizontal jets, whose volumes gave a good idea of the immense powers of the machine when in thorough working order.

No one considers the *Times* newspaper as an authority on scientific subjects. Indeed, its reporters, when dealing with such matters as trials of machinery, generally exhibit a blissful ignorance of all that on those occasions they ought to know. We would have thought that, ere this, constant detection, and we had almost added ridicule, would have rendered them more cautious. Their report of this trial, however, contains a sneering criticism on American fire-brigades and engines, which at once exhibits the good taste, scientific, and general information of the writer, in a light which shows that the *Times* has yet to learn not only a smattering of mechanical knowledge, but also the art of treating strangers with courtesy. International competitions afford a bad mark for newspaper insolence.

OSCILLATING ENGINES.

The most superficial examination is sufficient to prove that the modern steam-engine is not a creation, but a growth, and this not alone in the development or application of principles, but even in the smallest matters of merely mechanical detail. What we may call the science of construction was little understood a hundred years ago. Our ancestors could build large castles or cathedrals; a good-sized ship was not beyond their powers. Anything, in fact, which depended for success on the laws of statics, and had no moving parts, throve pretty well under their hands; but when it came to machinery, the case was different; and, from a watch to a flour-mill, all was more or less rough, cumbrous, heavy, and ill-constructed. We believe things would have remained in much the same state to the present day, had not the steam-engine exercised such a demand on the skill of our working population. Its introduction, too, opened a wide field for the application of machines, most of which depended as much for success on finish as the engine which was to give them motion. We find in the different forms under which steam machinery presents itself to our notice, an almost perfect record of the progress made by the arts since its invention, and it is highly improbable that anything but the very simplest arrangements, would strike early inventors as capable of general application. Thus, a working beam had been used, centuries before steam was thought of, for pumping and raising buckets from wells; and it was really the best contrivance Newcomen or Watt could possibly have used for the purpose they had in view. Almost the moment, however, that steam was employed to cause rotation, the defects of the beam system became apparent, although it was many years ere a different form of engine was generally employed. We of the latter half of the 19th century will perhaps say that the abolition of the beam was so obvious an improvement, that the inventors of the direct-acting system deserve little credit for originality. Easily said, when, Columbus-like, the egg is made to stand for us already; be this as it may, the oscillating cylinder, at all events, has crept more slowly to perfection than almost any other arrangement.

The first idea of the kind is doubtless due to Richard Trevethick. In a patent dated, March 24, 1802, to Trevethick and Vivian, they describe a vertical sugar-mill worked by an engine on this principle. But they go rather farther with their notions than the known merits of the system would justify us in following; for they propose, that not the cylinder alone, but boiler, grate, and chimney, should all swing on a vertical axis; the fly-wheel axis being vertical also, of course. Their patent, however, includes a claim for a cylinder on the modern principle. The invention met with little notice at the time.

Witty took out some patents from 1810 to 1813 for moveable cylinders. But the first oscillating engines ever really made, were constructed by Aaron Manby, of the "Horseley Works," Staffordshire, in 1821. Many of these engines were set to work with more or less success. The valves seem to have been the great source of trouble; and the difficulties entailed by the want of a good means of regulating the inlet and outlet of the steam proved a powerful obstacle to the more general adoption of the oscillating system, until two 10-horse power engines, fitted with slide valves nearly as now, were erected on board the "Endeavour," a steamboat plying between London and Richmond, by Messrs. Maudslay and Field, in 1828. Messrs. Penn subsequently undertook the construction of this class of engine on the largest scale, and under their skilful hands it has received improvements which cause it to rank as one of the very best forms of paddle-wheel engine we possess; indeed, it is far from improbable that, after a little time, paddle steamers will be fitted with this class of engine exclusively, as its peculiar arrangements are admirably suited to the enormous

cylinders and slow-speeded pistons, which such vessels require. Oscillating cylinders, weighing over 20 tons, are by no means uncommon.

It is a little strange that a form of engine so well adapted to cramped situations has not as yet been employed to any extent to drive the screw. Several geared engines have been fitted with it—the "Great Britain," for instance; but we believe we are correct in stating that it has been very sparsely, if at all, employed to drive the screw shaft direct. We cannot see any objection to its use for such a purpose, for which, indeed, it seems exceedingly suitable, especially on board narrow vessels, where it is difficult to get room for a long stroke or connecting rod. No difficulty should be experienced with the valve gearing; and the cylinders, if horizontal, would of course balance pretty fairly on their trunnions. By such an arrangement, a great deal of weight would be saved in guide blocks, fixed guides, crossheads, double piston rods, &c.; to the amount of many tons, perhaps, in large engines. The whole system has been too well tried on the largest scale, to admit of much doubt of its success on one much smaller, if not less powerful. What we should lose or risk by its introduction for the purpose is not very apparent, and it is quite certain that we should, at all events, gain a long stroke and a light engine; advantages great enough to entitle the question to some thoughtful consideration.

EFFECTS OF VIBRATION ON WROUGHT IRON.

More than twenty years ago, the cranked axle of a locomotive happened to break during the passage of a train from Paris to Versailles. The breaking of a crank-axle is, unfortunately, no very uncommon occurrence; in this case, however, it led to the deaths of nearly one hundred persons. An accident involving such a wholesale destruction of human life engaged universal attention, and the entire array of Continental science was soon called upon for an explanation of the disaster. It was noticed that the fractured part of the axle showed a crystalline structure; and upon this appearance the explanation was founded that the jarring naturally induced in a railway axle through the vibrations caused by the engine and rail led to the deterioration and ultimate destruction of its cohesive properties. The eminent French savant, Arago, considered that the crystallization of wrought iron was only a matter of time, the length of time being in an inverse ratio to the amount of the vibration. Ever since that period the question as to the "crystallization" of iron has been argued and re-argued *ad infinitum*, by scientific and practical men, but without any definite settlement of the matter. Some have altogether denied the fact that any structural alteration in iron is caused by vibration; while others have as strenuously asserted that such a change does take place, accompanied with an actual metamorphosis in the structure of the metal. Several Papers have been read on this question before the Institution of Civil Engineers, amongst which we may mention Mr. Hood's, on the "Changes of Internal Structure of Iron" (Proceedings of the Institution of Civil Engineers, Vol. II., page 180), and Mr. Thorneycroft's on the same subject (Pr. Ins. Civ. Eng., Vol. IX., page 295). In 1850, Mr. T. E. M'Connell, read a Paper on "Railway Axles and their Deterioration," and the discussion that ensued elicited great difference of opinion on this question amongst the members of the Institute. The late Robert Stephenson controverted the assertion that iron was liable to crystallize, or to change its molecular structure, through vibration. He instanced the Cornish engine beam with a strain of 56 lb. per inch, and, nevertheless, "working eight or ten strokes per minute for more than twenty years;" and the connecting rod of a locomotive vibrating eight times per second for several years, "making more than 200 million times altogether, but the iron retained its fibrous structure." Mr. Slate stated that he had "made a machine in which he put an inch square bar, subjected to a constant strain of 5 tons, and an additional varying strain of 2½ tons, alternately raised and lowered by an eccentric 80 or 90 times per minute, and this motion was continued for so long a time that he considered it equal to ninety years railway working, but no change whatever was perceptible, and, therefore, he was one of those who did not believe in a change from a fibrous to a crystalline structure." Now, with all deference to such an authority as Robert Stephenson, it appears to us that the connecting rod of a locomotive is in a very different condition as regards jar and vibration to the cranked wheel or axle driven by the rod. There is no absolute jar on a connecting rod *working under ordinary circumstances*, and where the engine is properly balanced the rod suffers very little vibration. With the wheel and axle, however, the case is very different. There is a continual jarring—what may be termed a true jar—produced by *metal hammering on metal*. The inequalities of the permanent way, and the various oscillations of the engine and carriages must cause a very powerful and continued vibration of the locomotive and other axles. In the case of the Cornish engine there is none of the jar produced by the impact of metal on metal. This was also absent in Mr. Slate's experiments. We have noticed that the long-continued "chipping" of cast iron with a chipping chisel will often cause the head of the hammer to break in two, especially if the hammer be not struck truly on the chisel head. Here we have a somewhat similar case to that of a wheel on a badly kept permanent way.

There is one very common form in which iron is used that is peculiarly favourable to the development of this jarring action. The different links of a common chain or cable have a continual tendency, when in use, to rattle and strike against each other. The iron forming a chain is necessarily cut up into a number of different parts, which are often obliged to reciprocate each other's blows while the chain is performing its duty; and, in addition to this, chains are often exposed to sudden and powerful tensions. We thus find that the greater number of complaints as to structural alterations in wrought iron have pointed to chains. Mr. M'Connell, while speaking on "Railway Axles and their Deterioration" at the Institution of Civil Engineers, 1850, mentioned that another striking instance of the conversion of tough wrought iron into a brittle material is shown in the chain slings used for carrying the bars during the process of hammering at a forge. "He had lately an opportunity of observing a chain which had been in use for this purpose, and had become so extremely brittle that it was more like glass in its fracture than the strong tough iron which it had been when first made; and he was satisfied that it had only been subjected to this extreme jarring action for a few months, and had not been otherwise applied." The chains used on inclined planes are also stated to break very soon. It is notorious that the crane chains used in engineer's shops almost always become brittle after being two or three years in constant use; their original condition is, however, restored by annealing. The chains used in drawing the "stuff" in the Cornish mines are generally withdrawn from the shaft after six months' use. They are then rolled in a heap, and covered with a sort of cylindrical furnace, and brought to a red heat. This operation is intended to do away with the effect of the vibration. Several of the witnesses before the 1860 "Select Committee on Anchors and Chain Cables for the Merchant Service," recommended a similar operation for the chain cables of ships, to be repeated periodically in conjunction with a system of re-testing. This deteriorating process in cables is so fully acknowledged by practical men, that Mr. T. M. Gladstone, in his evidence before this committee, even put a numerical value upon it, and stated that the chains of a light vessel which are constantly at work would deteriorate at the rate of 10 per cent. in two years. In ordinary cases, the deterioration of the iron would amount to 5 per cent.; and "it would be continuous, until the chain would ultimately break as short as a pipe stem." The instances we have cited are thus drawn from the experience of the workshop, the forge, the mine, the railway, and from seafaring life; and the concurrent and universal testimony of those whose lives—daily and hourly—depend on iron, certainly points to the fact that iron is rendered brittle by vibration or undue tension, perhaps combined with other causes, such as deflection, or any sudden chilling through frost, or by contact, while heated, with cold water.

The theories propounded to account for these molecular changes in iron have been very varied and numerous. Until the experiments lately made by Mr. Kirkaldy on wrought iron and steel, it was generally assumed that a crystalline structure, like that of cast iron, was induced in wrought iron by means of its gradual deterioration through the causes mentioned above. Mr. Kirkaldy has, however, shown that a crystalline appearance is the invariable result when wrought iron is *suddenly* broken; when *gradually*, a fibrous appearance is the result. He appears to consider that this observation has settled the question—as a crystallized fracture can be induced in any iron, the crystallized appearance noticed in iron after it has been in use is merely due to its sudden breakage. Now, as all his experiments appear to have been made on new iron; on "pieces taken promiscuously from engineers' or merchants' stores, except those marked *samples*, which were received from the makers," the question as to the gradual deterioration of iron while under the influences of wear and tear is still as far as ever from a solution. It would, no doubt, be difficult to adduce "conclusive proof that the iron which is produced of a crystalline character was once fibrous." Perhaps the only way would be to subject a tested bar to a true percussive action through some time, and to then test the resulting diminution of tensile strain. The experience as to iron undergoing a gradual deterioration under certain circumstances is too universal to be discredited. The multitude of theories put forth to account for it bear witness to the fact, although an explanation of the phenomenon is still required. Mr. Hood, in the Paper we have alluded to, ascribes the changes in iron to the conjoint action of "percussive heat and magnetism." Mr. Thorneycroft ascribes it to deflection. Some adduce magnetism alone as a principal cause; others point to the original impurities in iron, such as sulphur, phosphorus, arsenic, &c. Mr. Roebling, a distinguished American engineer, assumes that the drawn-out fibre of wrought iron is "composed of an aggregate of

pure iron threads and leaves, enveloped in *cinder*." Wrought iron thus becomes brittle under long-continued vibration under tension, "*because the iron threads and laminæ become loosened in their cinder envelopes*."

There is no doubt, also, that the question has been complicated by many specimens being originally weak, either from defective quality or from being burnt in the forging. The fact seems to be that we are very ignorant as to the ultimate molecular structure of iron, or, indeed, of any other substance. Why does the presence of a percentage of carbon, more or less, exert such a mysterious influence on the cohesive powers of iron? We may never know much more about molecular structure until, in combination with experiments such as those of Mr. Kirkaldy, a powerful microscope shall have been used to investigate the structure of the specimens. It is difficult to believe that a change in tensile strength is not accompanied with a change in molecular structure. Robert Stephenson pointed to the use of the microscope for examining the differences in fracture of so-called crystalline and fibrous iron. He stated that, under the microscope, there was no difference between a fibrous and a crystalline specimen of iron.

We are inclined to offer a fresh explanation of the deterioration of iron under vibration, and of the partial restoration of its tensile strength by annealing. Each bundle of fibres in a bar of wrought iron consists of a number of very small crystals. We might compare a piece of good wrought iron, properly forged or rolled, to an assemblage of strings, each string being composed of a thread of small crystals. An exaggerated picture could be afforded of this, by imagining a bundle of glass threads. If the iron has been burnt in the manufacture, instead of these threads being continuous, they are broken in different parts of their length. The same effect is produced after a long continued jar; there is a solution of continuity in the fibres—they are shaken apart, and the fibres of the iron threads are broken up into shorter pieces. Deflection will produce a similar effect. Frost, or a sudden chill, will contract the fibres, and they will be pulled asunder. On the application of a low red-heat—the process of annealing—the ends of the crystal threads again come into contact through the resulting expansion. The expansion of the whole mass favours the ultimate coherence of the fibres; and, on contracting, the wrought iron returns to its pristine state—that of a bundle of crystal fibres. Thus, under long-continued vibration—before it receives its *coup de grâce*—it is already partly broken; its intimate structure, inaccessible to the eye or to atmospheric influences, is already partially in fragments. The application of a *gradual* strain to iron thus deteriorated and brittle, would have the effect of drawing out the fibres that were still entire, leaving undisturbed the parts that had already given way in the interior. According to this, it will be evident that the face of the fracture—at a right angle to the axis—of a bar of iron injured by vibration, would show no signs of injury; but if it were possible to examine the structure in a like line parallel to the axis of the bar, it would, perhaps, be seen that the fibre was broken up into pieces of different lengths.

BOILER EXPLOSIONS.

THE management of steam-power in England is a disgrace to the wisdom and intelligence of which we are, as a people, so fond of boasting. The daily journals have become a record of misery and destruction, which seems to extend in every direction where steam-power is employed. Explosion follows after explosion, with a rapidity which is awful, and a destructiveness which cries loudly for the interference of some one who has power to save.

We do not hesitate for a moment to say that the principal cause of such calamities is to be found in the gross negligence, to call it by no stronger term, of those whose business it ought to be to take every precaution, which science and experience dictate as a means of securing the lives in a manner entrusted to their care. We know well enough that, without the interference of some totally uninterested power or influence, the evil effects of this negligence will never be overcome, and therefore we assert that it is high time the Government stepped forward and passed such laws as may lead to the compulsory inspection of boilers. It is all very well to say that the safety of a man's own property, is an influence powerful enough to secure efficient supervision. It has notoriously failed to do so hitherto, and it will fail still, because, however interested the proprietor may be, his task in such a case is necessarily delegated to another, and who can answer for the competency or activity, of the delegate? Besides, it is not in manufactories where this influence is most powerful, that boilers explode most frequently; we find that by far the larger number of these catastrophes occur in our mining districts, where the management of steam machinery is frequently reckless to a degree; perhaps because an explosion at the pit's mouth, seldom entails as much destruction to property as if it took place in a mill or a factory.

We are always slow to propose the interference of Government in anything which nearly concerns our trade or manufactures. Arbitrary rules and laws are frequently troublesome and vexatious, but that by no means proves that they are not occasionally necessary. We believe it is necessary for the protection of the public that a law should be passed enforcing the inspection of all stationary boilers, by a well-trained and properly organized staff. Not only does the safety of the men employed about steam machinery demand such a course, but the prevention of the dire secondary calamities which follow on an accident of the kind as well. As an almost invariable rule, we find the works, of which the destroyed steam engine was the moving power, brought to a stand still until the necessary repairs are effected, while numbers are thrown out of bread and become a charge on the parish for a like period.

We are weary of inquests. We cannot see that they are productive of any real good. They fulfil a certain purpose; they occasionally determine (?) the cause of the accident; certain persons are, perhaps, reprimanded, others imprisoned; but they cannot possibly check an evil which we fear becomes daily more extended throughout the land. Science, too, does little for us: is it because there is really no field open for her? While engineers split hairs about the cause of the violence of explosions, they shut their eyes to the fact, that in the miserable condition of boilers will be found the key to half the mischief. Boilers, properly made, not overworked, carefully inspected, and effectually repaired, seldom or never explode. We feel little doubt that a thoroughly well organized expedition of inspection, would bring facts to light, and reveal a state of affairs which would prove sufficiently startling. The engineer, residing in a district where coals are dear and steam machinery valuable, can have but a feeble idea of the phases which boiler engineering presents in districts where coals cost little, and the rudest machinery answers every purpose. Of what avail is it that a boiler has been well made, if that process has taken place thirty years before? Even in the best hands and under the charge of those who are most disposed to exert prudent caution, the report of the Manchester Boiler Association reveals facts sufficiently suggestive. Such associations have conferred a boon on districts; and we earnestly hope that the time is not far distant, when an efficient and rigid Government supervision will answer the same purpose, and fulfil the same ends, for the country at large. In inspection, and in it alone, can we hope to find a remedy for a state of affairs which would be deplorable, were it not disgraceful, and the sooner the necessary work is commenced the better—compulsory, it seems, it must be, and ten thousand times better a compulsory inspection than none at all.

HAWTHORN'S PUMP-VALVES.

MESSRS. HAWTHORN, engineers, Newcastle-upon-Tyne, have recently patented an improvement in pump-valves. The improvements consist in the application of an annular double-mitre-valve to pumps of every description, but specially adapted for the air-pumps of surface condensing engines, or where a free passage, with a small rise or lift, and where a quick action is desirable, as in the case of pumps worked at high speeds, and, further, in the application of a peculiar ball clack or valve, or any number of them, for the same purposes. The double beat or mitre valve first named contains an annular space or ring between the inner diameter of the outer mitre and the outer diameter of the inner mitre of sufficient area to allow the water or other liquid a passage proportioned to the requirements of the pump. The upper portion or lid of the valve is formed of cast iron and wood, the wood

FIG. 1.

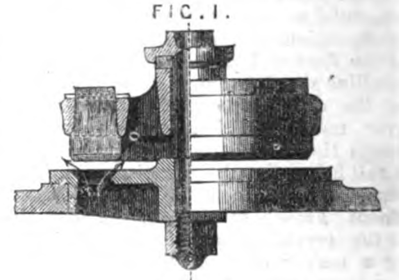
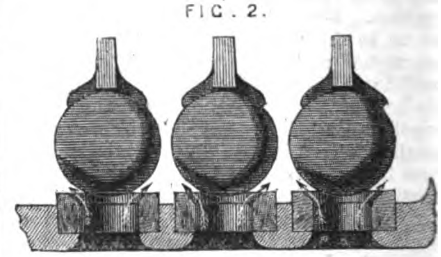


FIG. 2.



part forming the mitres corresponding with those formed in the annular space in the valve seat. The lid of the valve is guided by a centre bolt of copper or other material with a collar or stop on the top end of it, by which the lift of the valve is regulated, as clearly shown in Fig. 1 of the engravings. The ball clack or valve, shown at Fig. 2, consists of a circular seat of hard wood fitted into a plate forming the bottom of the valve box, upon which a ball falls and closes the passage at each stroke of the pump. The balls may be made of cast iron or other material, either hollow or solid, and the lift regulated by suitable provision.

ROBERTS' FLYER FOR SPINNING FRAMES.

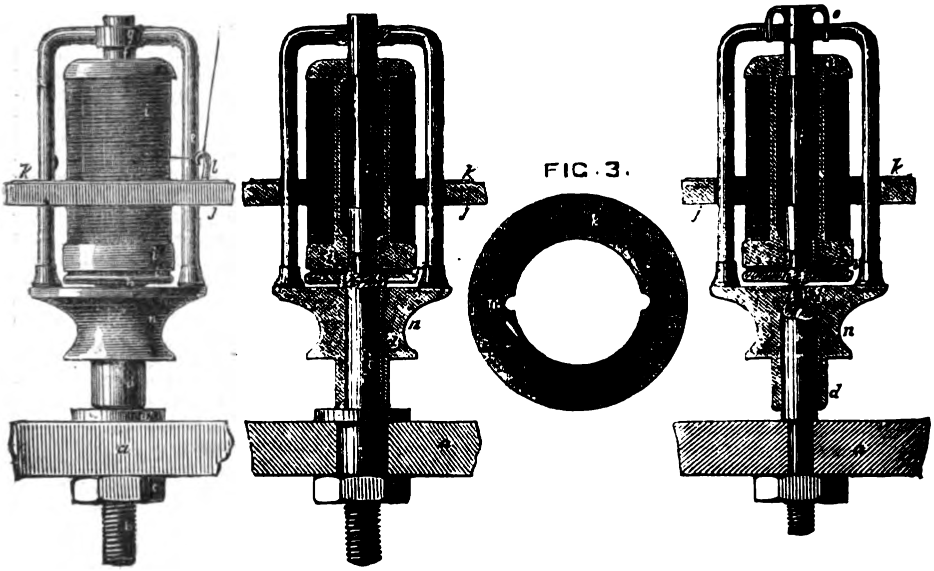


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

ROBERTS' FLYER FOR SPINNING-FRAMES.

A VERY important improvement in flyers for spinning-frames has just been patented by Mr. J. Roberts, of Pendarren House, near Crickhowell, Brecon. The invention is fully illustrated in the accompanying engravings.

The object is to obtain a better "drag" to the thread, yarn, or roving, whilst being wound on to the bobbin, in preparing and spinning fibrous substances, than is usually obtained.

For this purpose the flyer of a preparing or spinning frame is made, somewhat in the form of a parallelogram, the lower side of which may conveniently be a circular or other-shaped metallic plate, which is firmly secured to a neck or socket, and upon this socket a whorl or pulley is fixed. This socket runs upon a suitable stud or pin, which is screwed or otherwise fastened to a strong rail. The flyer is driven by a band from a driving cylinder passed round the said whorl in the usual manner; or it may be driven by any other convenient means. Through the centre of the head of this flyer a spindle is placed, which passes through the bobbin, and prevents it from falling sideways. The spindle is fitted loosely in its bearings; that is to say, the spindle is free to turn in a hole or bearing in the head of the flyer. The lower end of the spindle is also free to turn in a cup or bearing in the stud or pin which supports the flyer and socket, or in a cup in a plate screwed, or otherwise fastened, to this stud or pin, which plate is called the "dead plate." Sometimes the upper end of the spindle is fitted with one or two projecting hooked arms, which, coming in contact with the outside of the flyer head, causes the spindle to revolve with, and at the same speed as, the flyer. The dead plate serves as a base or support for the bottom of the bobbin, and it is by the friction of the bobbin upon this dead plate, or upon appropriate washers interposed between the bobbin and plate, that the "drag" or retardation of the rotation of the bobbin is produced. When the bobbin is to be "doffed," that is, removed from its place within the flyer, the spindle is raised, and the bobbin can then be removed. The spindle not being of much greater length than the bobbin, the bobbin cannot be moved up and down the spindle for the purpose of laying the thread, yarn, or roving upon its whole length, as is done in ordinary spinning-frames; therefore, to provide for the necessary operation of thus laying on the thread, a ring, or other well-known device, is used, which, while it revolves with the flyer, is traversed or moved up and down the flyer by a "lifter rail," upon which the ring rests, or by other convenient means; on this ring are fixed eyes, or twizzles, or loops, through which the thread or yarn coming from the delivering or front rollers of the frame passes on to the bobbin, and consequently the up-and-down motion of the ring with its eyes guides the thread or yarn in a proper direction upon the bobbin. By the compactness of the flyer and spindle, a high velocity in spinning or preparing is obtained, without much shake or "wabble" in this part of the machinery. The "drag" is thus rendered more equable, while, by the peculiar action of the spindle, a more regular and even drag than is usual is obtained.

Fig. 1 is an elevation, and fig. 2 a longitudinal section, of a spindle and flyer, and parts connected therewith, constructed according to this invention. *a* is a rail, to which a pin or stud *b* is screwed by a nut. *c, d*, is a socket or neck fixed to the flyer, and resting upon a collar or bearing d^1, fixed to the stud *b*. *e, e*, is the flyer; *f* is the spindle, the upper end of which revolves in a bearing or circular aperture *g* in the flyer head, while the bottom or lower end revolves in a cup *s*, formed on the top of the stud *b*. *h, h*, is the dead plate, which is screwed on to the stud *b*, upon which the bobbin *i* may rest directly; or, as is represented in the engravings, a washer of cloth i^1, or other suitable material, may be interposed between the bobbin *i* and dead plate *h*. *j, j*, is the lifter rail, upon which a ring *k* rests. This ring *k* is shown detached in plan in fig. 3. It carries eyes or twizzles *l*, through which the yarn passes to the bobbin; it has also nicks *m* cut in it, to fit over the flyer *e*, in order that the flyer, in revolving, may carry the ring round with it. *n* is a whorl or pulley, fixed to the socket or neck *d*, and by which motion is communicated to the flyer through a driving wheel in the ordinary manner.

Fig. 4 represents, in longitudinal section, a modification of the arrangement shown in figs. 1 and 2. In this modified arrangement, the stud *b* is formed conical at top, and the socket *d* cupped to fit over and run upon it, or this conical bearing may be reversed. The bearing surface, and consequently the friction, are much less than when the socket runs upon its base, as in the arrangement previously described. The dead plate *h* is secured to the top of the pin *b* by a small pin or screw, which passes through the top of the socket *d*, but in such manner as not to interfere with its rotation. The bearing *s*, for the lower end of the spindle, is formed in the dead plate *h*. The spindle may be fitted with two hooked arms *o, o*. These arms catch against the head of the flyer, and the spindle is thus caused to revolve with the flyer.

ON THE TRUE THEORY OF PRESSURE AS APPLIED TO ELASTIC FLUIDS.*

By R. MOON, M.A.

IT is the author's object—

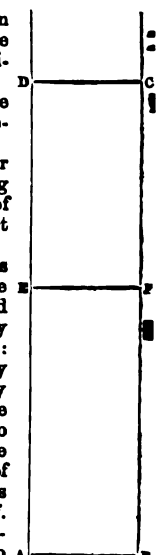
I. To show that, in elastic fluids in motion, or tending to move, it is not generally true, or at least not accurately true, that the pressure depends solely on the density, as is assumed in the ordinary theory of the motion of elastic fluids.

II. To show that, within certain limits and under certain circumstances, pressure may be transmitted instantaneously from one point of an elastic fluid to other points situated at finite distances from the first, before any change has been effected in the density of the intermediate fluid—in a manner analogous to that in which, in the theory of dynamics as applied to rigid bodies, force is assumed to be propagated instantaneously from one point to another.

III. To show that in elastic fluids in motion, or tending to move, the pressure at any point in a given direction will consist of two parts—one depending solely on the density, which will be equal in all directions; the other depending on the state of motion throughout the fluid generally, and which will vary with the direction in which the pressure is estimated. The former of these two constituents the author proposes to designate the statical pressure; the latter, the instantaneous pressure. The true pressure at any point in a given direction will be found by taking the sum or difference of the statical and instantaneous pressures, according to circumstances.

IV. To indicate the manner in which the instantaneous pressure may be represented mathematically.

V. To show the bearing of the proposed correction on the received theory of sound.



A B C D is a vertical cylinder closed at the base A B, and having an air-tight piston C D capable of moving freely in the upper part of it.

Below the piston the tube is filled with air, which at the time *t* is wholly free from impressed velocity, but in which the density varies in the following manner: viz., from A B up to an imaginary horizontal plane E F, the density is uniform; while from E F the density gradually increases up to C D, in such a manner that the effective force at every point of the air between E F and C D is exactly the same, and equal to *f*. Above the piston a vacuum exists. The piston is supposed to have weight, but, for the sake of simplicity, the air under the piston is supposed to be unaffected by gravity. The weight of the piston is supposed to be such that the effective force on each particle of the piston is the same as that on each particle of the mass of fluid E C, viz., *f*.

If the pressure exerted by the air which originally occupied the space A F on that which originally occupied the space E C were to continue during the time t_1 the same that it was at the time *t*, every particle of the former mass of air (which we will designate as the air in A F) would during the time t_1 be under the action of the same effective force *f*, and would therefore in that time describe the same length of path, viz. $\frac{ft_1^2}{2}$; and on this supposition no change would take place in the density of the air in E C during the time t_1. But, according to the received theory, the pressure of the air in A F on that in E C will continue unchanged until the density of the part of the air in A B which abuts on the common boundary of the two masses of fluid has changed. Hence change in the density of the air in A F must precede change in the density of E C.

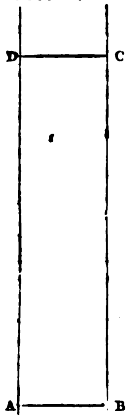
On the other hand, so long as the pressure of

* Read before the Royal Society.

of the air in E C on the air in A F remains unchanged, the air in A F will remain at rest, and will therefore undergo no change of density. But as, according to the received theory, the the pressure of the air in E C on the air in A F depends on the density of the part of the air in E C which abuts on the common boundary of the two masses of air, it follows that change in the density of the air in E C must precede change in the density of the air in A F.

But we have before proved the exact contrary, viz., that change in the density of the air in A F must precede change in the density of the air in E C. It is evident therefore that, according to the received theory, no change can, under the circumstances above supposed, take place in the density of either mass of air.

If, however, the density in A F remain unchanged, we have already seen that every particle in E C will in the time t_1 describe a space equal to $\frac{ft_1^2}{2}$; and if the density in E C remain unchanged, we have equally seen that every particle of A F will have remained at rest during t_1; which is a contradiction. It appears, therefore, that in the case we have been considering the received theory leads us to an absurd result.



It can with still more facility be shown that the received theory leads to an absurd result in the following case:—

A B C D is such a tube as before described; but in the present case we shall suppose it filled below the piston with air of uniform density in equilibrium, the pressure of the air being such as to exactly sustain the weight W_1 of the piston. As before, a vacuum is supposed to exist above the piston, and the air is assumed to be unaffected by gravity.

If a second weight W_2 be placed upon the piston, we know that the equilibrium will be destroyed. But if it be true, as the received theory asserts, that the pressure of an elastic fluid depends solely on its density, the pressure of the air on the lower surface of the piston will be exactly the same after W_2 has been introduced as it was before W_2 was introduced; and, since action and reaction are equal and opposite, whatever be the pressure of the air in the piston, the same will be the pressure of the piston on the air; so that the pressure downwards of the piston on the air beneath will be the same after W_2 was introduced as it was before; and the system therefore will continue in equilibrium after W_2 has been introduced; which is absurd.

By an argument too elaborate to be indicated within the limits of this abstract, the cause of the failure of the existing theory in the instance first above considered is shown; and it is proved that in the second case the effect of the introduction of the weight W_2 is instantaneously to propagate through the air to a definite distance below the piston a finite increase of pressure; such increase of pressure having its maximum immediately underneath the piston, and thence gradually diminishing till, if the tube be long enough, it finally vanishes. The depth to which the instantaneous increase of pressure will extend will be defined by means of two considerations:—1st, that the effected force on every particle of the piston and weight must be exacaly the same as that on the air immediately below it; and 2nd, that the aggregate moving force developed in the piston W, the weight W^2, and the portion of the air in the tube through which the instantaneous pressure extends, must be equal to the moving force developed by gravity in W^2 when free to move *in vacuo*.

It is also shown that if instead of the weight on the piston being suddenly increased it were to be suddenly diminished, exactly analogous results, *mutatis mutandis*, would occur—the effect of the sudden removal of part of the weight being instantaneously to *diminish* the pressure to a finite distance below the piston—such diminution having its maximum immediately beneath the piston, and thence gradually diminishing till, at a certain distance below the piston, the whole pressure will be exactly the same as it was before any part of the weight was removed.

If the piston were wholly removed, the pressure of the air originally in contact with it at the instant of removal would be zero.

It is then shown that the addition to or diminution from the weight on the piston in the case last considered will produce no immediate change in the horizontal pressure in the air below the piston.

It is next shown that in cases where there is no impressed velocity, as in the case first considered in this paper, the instantaneous pressure p_i may be expressed in terms of its partial differential co-efficients, and of the density at the point where the pressure is being considered.

It is also shown that, in the general case, where the whole or a portion of the fluid is endued with velocity, the instantaneous pressure may be ascertained by adding to the expression of the last paragraph a term involving the density and the partial differential co-efficients of the velocity at the point where the pressure is being considered.

It is finally shown that, in the case of the transmission of a pulse through a cylindrical tube where the motions are small, the equation of motion will be of this form—

$$\frac{d^2y}{dt^2}=\frac{a^2d^2y}{dx^2}-\frac{b^3d^2y}{dxdt};$$

where *x* denotes the distance from the origin measured parallel to the axis of a given stratum in the state of rest, *y* the same distance at the time *t*, and a^2 and b^2 are constants, the value of a^2 being the same as in the ordinary theory.

As this equation leads to the conclusion that there are two velocities, it results that, except perhaps in very rare instances, in which a duplication has been observed in sounds heard at very great distances, the proposed correction of the theory of the motion of elastic fluids will not practically affect the theory of sound.

By the method adopted in the case of elastic fluids, the author conceives himself to have established that, in what are commonly termed inelastic fluids, the pressure during motion will not be equal in all directions.

ON INDIAN RIVER STEAMERS.*

In laying before you a few suggestions on Indian river navigation, I will confine my remarks to the river Indus and its tributaries. It is at certain seasons of the year shallow and tortuous, with a current of from 1½ to 3 knots per hour, according to the season—having, like the Nile, periodical inundations. At one place (Sukkur), where a rocky island divides the stream, the current at the high season is from 8 to 9 knots, but this pass is only about three-fourths of a mile in length. There is another peculiarity of the Indus: its shifting channels. It often happens that where there is 8 or 9 ft. water one week, in the following week there will not be as many inches. The banks are also often swept away, taking with them whole native villages, so that any system of buoying off the channel is out of the question.

The navigation is guided by native pilots, who know by the surface of the water the channel to take; and they are often deceived, at times getting into a *cul de sac*, when they must about ship and seek another channel. As to the prospects of trade on the river, I do not think there can be a doubt, as a glance at the map of India will show that it runs through a large tract of well-populated country. At about 500 miles from its mouth it is joined by the Chunab and Sutlej, the Chunab being again joined by the Jelum and Ravee, the Indus holding on its course north until it penetrates the Himalaya mountains and enters Thibet. However, it has not been navigated further north than Attock, and this may be said to be the utmost point navigable. The principal towns are Sukkur on the Indus, Moultan on the Chunab, Lahore on the Ravee, and Ferozpoor on the Sutlej, thus forming the Punjab, or country of the five rivers.

Before describing the kind of vessels I would suggest for its navigation, I will take a review of the vessels that have already been tried. Shortly after the conquest of Scinde by Sir Charles Napier, the East India Company, seeing the advantage of steam, had two small steamers built of light draught. They were 80 ft. long and 18 ft. beam; their load draught was 4 ft., with engines of 50 nominal horse-power. This was a great step from the native boats; but owing to their small power and deep draught of water, they could only take Government stores and a few Government passengers; and, although the distance from Kurrachee to Moultan is only about 800 miles, they generally took five weeks to reach the latter place. The downward passage was accomplished in from seven to ten days. This will even look a long time; but it must be remembered that they can only steam in daylight, laying to at the bank at night, and taking their fuel (wood) for the following day.

They have gradually enlarged the size of their steamers as they built new ones, until the last built, just before India was united to the British Crown, were length 166 ft., beam 28 ft., depth of hold 8 ft., nominal horse power 120, their load draught 4 ft. 6 in. Now the great fault of these vessels was their draught of water and the length of time on the passage, twenty days being their average up passage; and at the high season of the river they could not go through Sukkur Pass, their cargo being unshipped below and transported in bullock carts to the upper side of the pass, and then put on board another steamer.

The next move for navigating the Indus was by a joint-stock company, with a *patent* for navigating shallow rivers. This was a steamer with an articulated train of barges, something like your mud barges on the Clyde, only that the bow of each barge was fitted into the stern of the preceding one, which was part of a circle, and tied together with triangular draw-bars working on ball and socket joints. The steamer was 200 ft. long, 20 ft. beam, and 5 ft. depth of hold. The first or joining barge was 40 ft. long, 18 ft. beam, and the same depth as the steamer. This barge was concave at both ends, so as to join the convex stern of the steamer and convex bow of the following barge. To complete the train, other four barges were joined in a similar manner, 100 ft. long, 18 ft. beam, and 5 ft. depth of hold, the whole train being 640 ft. long. The last barge was for passengers, having a deck-house, 60 ft. by 16 ft. Her stern was spoon-shaped, with a rudder attached. The bow of the steamer was also of the spoon pattern. The displacement of the steamer with engines and boilers was 185 tons, and the mean draught was 2 ft. 2½ in. The joining barge displaced 18 tons, draught of water 10½ in.; each of the 100 ft. barges displaced 39 tons, draught 10 in.; and the passenger barge displaced 63 tons, draught of water 1 ft. 4 in. This was their displacement without any cargo. The train was fitted with a great number of novelties, among which was a self-acting telegraph, to indicate to the steersmen of the other barges what direction the bow of the steamer was taking, the steamer as it were acting as a bow rudder to the rest of the train. On the steamer's bow was placed a frame with thirty lanterns, to throw a blaze of light ahead, to enable them to proceed in the darkest night. The paddle-wheels were six inches below the keel, that they might be used as crawlers when the train had not water to float in, having a supplementary engine, fitted with wheel gearing, to reduce the speed when crawling.

The last barge of the train was fitted with a drop pile. This was to pin the tail of the train if the bow should get aground when going with the stream, and prevent the doubling up of the train. None of these novelties were of much service. Once at Grizree the steamer was crawled off with six inches less water than her draught, but the bottom was a stiff clay. At another time in

* Read by Mr. R. Leys, before the Scottish Shipbuilding Association, March 2nd, 1863—James Hall, Esq., President, in the Chair.

Kurrachee harbour, where the bottom was sand, they just dug a hole in the sand without moving the vessel. The drop pile was once tried, but although it was an elm log 15 in. square, it nipped across like a carrot.

A number of experimental trials were made at a measured distance of 3,850 yards in Kurrachee harbour, the mean results of which were as follows:—With steamer alone, loaded to a mean draught of 3 ft., the speed attained, with an indicated horse power of 273·58, was 9·374 English miles. Her immersed midship section was 58 square feet. This was a very poor result, but from her block stern and formation of the bow little else could be expected. The next trial was with the 40 ft. and one of the 100 ft. barges connected, loaded to 2 ft. 10 in. With this a speed of 7·19 English miles was attained, the indicated power being 302·79-horse power, the immersed section of steamer being the same as on the former trial, the length of steamer and barges 340 ft. Another 100 ft. barge was connected, and the speed was reduced to 5·75 English miles, indicated power 332-horse power. Another 100 ft. barge was connected, thus making the length of train 540 ft. The speed was reduced to 4·33 English miles. The slip of the wheel on this trial was 51 per cent. I may mention that the engines were high-pressure, and the steam carried on these trials was from 90 to 110 lb.

After these trials, the train of steamer, 40 ft. barge, and 100 ft. barge, made an attempt to ascend the Indus; but although the *patentee* was on board, with a crew of thirty-two Europeans and forty-two natives, it was twenty-three days in making 420 miles. It was found quite unmanageable in the currents, oftener in a zig-zag than in a striaght line, first on the one bank then on the opposite. A second attempt was made, which was equally unsuccessful.

After this failure, alterations were made on the steering gear, and a number of trials made in the harbour with no better result as to speed—the steering rather improved. The train again started for the river; but before it was well out of the harbour one of the arms of the draw-bar broke, and the barges doubled round on the steamer, breaking in the stern and after compartment, when the steamer filled and sank in twenty-four feet water, the crew getting on to the barges. No lives were lost. Thus ended the train system, for a time at least, although a second train was ready for launching.

The steamer of this second train had now her block stern cut off, and lengthened 20 feet, with a pretty fine after run; the barges got bows and sterns put to them to suit them for being lashed alongside the steamer, or towed astern, as might be wanted. This steamer started for Moultan with one barge 140 feet long, going through Sukkur Pass at the height of the innundations, and reached Moultan in twenty-five days. This was a poor result, but it was only making the best of a bad job. Since then she has taken two barges and made the passage pretty regularly.

The next move for navigating the Indus was with steamers and railway combined—the Scinde Railway and Indus Flotilla.

The Scinde Railway starts from the Island of Keamaree, which forms the east side of the harbour of Kurrachee, and has its terminus at Kottree, on the banks of the Indus, about 130 miles from its mouth. This line is 110 miles long, and makes a very considerable saving in distance, but much more in time; the shortest water route to Kottree being 230 miles, but can only be used about seven months in the year, the N.W. monsoons causing a heavy surf all along that coast from April to September. The other water passage is by the creeks, which are very tortuous, and the distance to Kottree by them is computed at about 400 miles.

The Indus Flotilla Company had a steamer built on the Thames by a celebrated builder, and tried on that river. Her dimensions were, length 200 feet, beam 38 feet, and depth of hold 8 feet. She was propelled by a condensing three-cylinder oscillating engine, two of the cylinders being below and the third above the deck. At her trial on the Thames she attained a speed of 13 miles per hour, with 688 indicated horse-power; her draught of water was 1 foot 11 inches, and her immersed midship section 70 feet. This was no great result, but it exceeded anything she ever did in India. Whether that her boilers were not suited for wood fuel, or that the heavy teak decks and stringers fitted into her in India, was the cause of her falling off, I do not pretend to say: it might be both combined; but the fact was she did not make over 10 miles an hour in still water when tried in India. She was very unfortunate, breaking one of her piston-rods and smashing a cylinder. There were other six steamers built from this model one, and from my last account only one of them had been tried. The results were so unfavourable that not one of them was taken off the contractor's hands after being put up at Kurrachee, the company having purchased some of the boats belonging to the East India Company, and are carrying on their trade with them.

This is pretty nearly what has been done in navigating the Indus. To know the rock that others struck on was my reason for dwelling so long on what has been done already. It is a great part of the battle to know the dangers ahead.

I will now lay before you what sort of vessels I think would suit that or similar rivers. Light draught is of the utmost importance, combined with strength and moderate speed. To secure the first two qualities, steel or homogeneous metal should be used in the plates, frames, decks, and beams; and from the late improvements in the manufacture of the latter metal, it would not be much more expense, taking into account its smaller scantling for equal strength compared with iron; and further to strengthen the steamer longitudinally, two bulkheads to run from bow to stern, about 6 ft. from her sides, also to be divided into five compartments by thwart bulkheads above the longitudinal bulkheads, two trusses rising about 8 ft. above the deck at midship, with stanchions spaced about 10 ft. apart; the trusses to be of the T-section, and the stanchions tubes for lightness. For the third qualification, high-pressure engines and boilers of the locomotive class, using steel for piston-rods, connecting rods, and valve gear, and homogeneous metal in the framing, shafts, and cranks, cast iron only being used for the cylinders and valve casing; in fact, wherever the superior metal can be used, it should be adopted.

The description of vessels would be a steamer with two barges lashed alongside, or in going through the creeks or narrows to be towed astern. Dimensions for steamer to be, length 240 ft., beam 30 ft., and depth of hold 5 ft., with a co-efficient of fineness at 3 ft. draught of ·72. This will look full, but it must be remembered that it is nearly all taken from the two ends, the body of the vessel for about two-thirds her length being nearly a square box.

The barges to be, length 150 ft., beam 22 ft., and depth of hold 5 ft., co-efficient of fineness ·75, divided into three compartments with thwart bulkheads. The decks to be of the same material as the vessels.

A steamer of the above dimensions would displace at 3 feet draught 432 tons. The hull and fittings I calculate would be 185 tons; engines, boilers, and water, 110 tons; this would leave for cargo and fuel 137 tons, allowing 37 tons for fuel, which would be ample for her longest run between stations. This would leave 100 tons for dead weight cargo of steamer.

Each barge would displace 206 tons at 3 ft. draught. Weight of each 56 tons for cargo to each barge. This gives for steamer and two barges 400 tons of cargo, which, at the present rate of freight, 1d. per ton per mile for up freight, and ½d. per ton per mile for down freight, should leave a very good return upon the capital laid out, after clearing working expenses.

I am quite aware that fulness increases the weight of the vessel herself, and tends to diminish the speed; but I wish to make her an owner's vessel, to carry a fair load upon the least draught of water. Now, I think you will agree with me that fulness has something to do in this respect; and as I do not think it advisable to make her longer for handiness in working in the river, the only other resource would be giving her more beam. This, I think, would increase the resistance as much as a little fulness in the vessel herself. Further, she is finer than any of the steamers on the river when I left. I believe the O. I. S. Company got one or two boats on the model of your Clyde river steamers; but what was the consequence? They drew 4 ft. 6 in., and were therefore useless for a part of the year. Light draught and to carry a fair cargo is indispensable. Speed, such as your Rothesay boats, is not wanted; 11 or 12 miles an hour would be ample, and with 600 indicated horse-power, I think would be realised easily, even taking into account the fulness.

The boats of the Government, with very bluff bows, and 1½ ft. more draught of water, the midship's immersed area being 126 ft. for steamer and barge, made 8 miles an hour with about 400 indicated horse-power. I am taking the indicated horse-power at 2½ times the nominal, and I am sure they did not exceed, if they came up to that; and again the "Sutlej," the altered train steamer, with one barge, went through Sukkur Pass at the height of the inundation, the current at the time said to be 8 miles, and the speed of the vessel 1½ miles per hour. Now, I have uniformly found that a steamer will go in still water more than the current and speed of ship added together. Some allowance must be made for shallow water; but the Indus is neither a shallow nor a narrow river generally: in some parts it is both, though not at the same place, and of course you must have vessels to pass these parts.

The expense of such a class of steamers would be about £450 per voyage for fuel, wages, and stores. The fuel is the heavy item, and as the demand for wood increases, there is no doubt the price will also rise; but as coal has been found in Scinde and also in the Punjab, that will soon become the fuel to be used. English coal might be used for the lower stations of the river; but to transport it to the upper stations would be very expensive, at least £7 per ton for the upper stations before being put on board the steamers. You must not understand that I think that *one* steamer and barges would be a profitable investment. The expense of management, agencies, and fuel stations would be too heavy; these would be the same whether there was one or a dozen of steamers sailing from each end weekly, or at least once in ten days; for this, four or six steamers and barges would be wanted.

The trade of the river is in a transition state, increasing every year to a large extent. The principal up freight is general merchandise, piece goods, beer, and metals; the down freight is raw and manufactured silks, wool, indigo, and various kinds of oil seeds, to which I hope soon will be added cotton.

The passenger traffic is mostly native, and though not yet so numerous as on the Clyde in the summer time, it has increased greatly, and will continue to increase as facilities are afforded them, for they are a very migratory race. Cabin accomodation is not required to any large extent: the natives are all deck passengers, and even the few Europeans that travel prefer what is called a first-class deck passage. This simply means to be victualed in the cabin and sleep on deck.

No bulwarks are required for steamers or barges, but a light rail and netting, with awning stanchions fitted for double awnings, with a space between the awnings of about 18 in.; the lower awning to have hanging curtains all round.

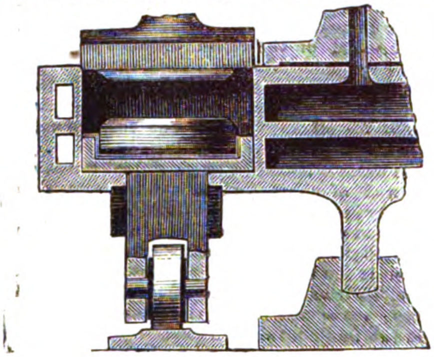
The engines, as I formerly stated, should be high-pressure of the simplest construction. I think diagonal cylinders of about 26 in. diameter and 5 ft. stroke, working steam at 100 lb. per square inch, and cutting off at half-stroke, with a piston speed of 350 ft. per minute, would be a suitable size. Although they take up a large space in the vessel, they distribute the strain to an equal extent. As the water of the Indus is very muddy, a filter is indispensable for the feed water. One placed in the bilge of the vessel,

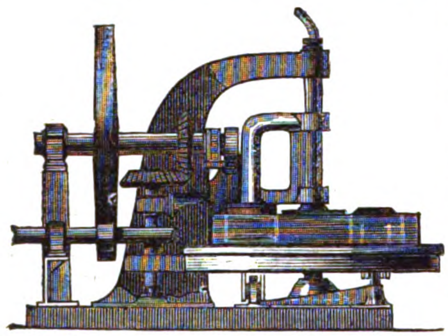
with a steam pipe attached to reverse the current at pleasure, and clean it out, would be suitable.

The boilers to be of the locomotive class, suitable for wood fuel; the furnace doors large, Scinde wood being in crooked billets, generally supplied in from 3 to 4 ft. lengths. The funnel to have a spark catcher similar to those on the American locomotives; the ash pans to be used as feed heaters, with safety escape valve connected to each.

HADFIELD AND ATTKINS' BRICK AND TILE MACHINE.

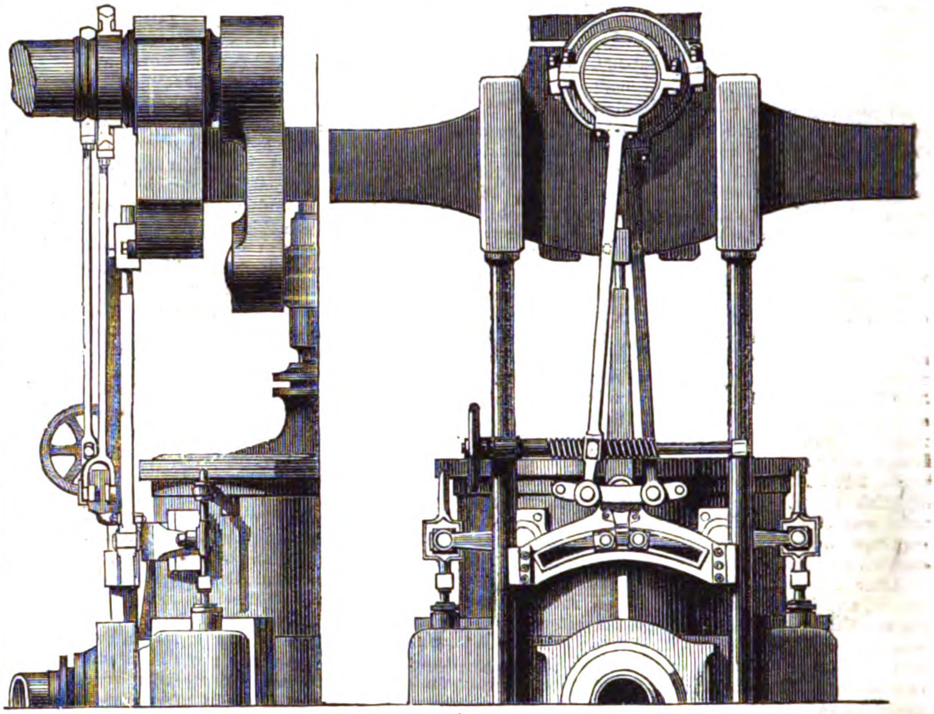
THE engravings show a machine for making bricks and tiles, the invention of Messrs. Hadfield and Attkins, of Hadfield, Derby. The invention consists in the construction and employment of a revolving table or frame, upon or in which any convenient number of moulds open at the top and each fitted with rising bottom dies and pistons (actuated as hereinafter described) are placed, and a rising and falling main piston actuated by a crank, and also working radially into and out of each succeeding travelling mould passing respectively under the said piston as the table revolves. The travelling mould pistons are made





in box form open at the top to receive cushion dies, these pistons form the bottoms of the moulds, in which they are accurately fitted, and are also caused to rise and fall therein more or less as required, and to operate by their upward pressure simultaneously with the downward pressure of the main piston working into and out of each mould as before described. The travelling mould pistons and bottom dies are actuated by two semicircular inclined planes fitted upon a bed plate under the revolving table, upon which inclines the bottom dies and pistons are respectively supported and travel as the table revolves, and are thereby caused to rise and fall in the moulds. The sides of these moulds are made hollow or in double case to receive steam, hot water, or air for heating the same, to prevent the necessity of lubrication. The revolving table and rising and falling pistons of the machine are actuated by suitable gearing driven by a steam-engine, or otherwise; and the bricks, tiles, clay, or other materials, having been thereby subjected to the required compressing forces and having received the desired form, are lifted out of the moulds by the continued rising of the bottom piston along the circular incline, until it arrives at the highest point thereof, when the compressed articles are removed and their places supplied by other materials.

CAIRD'S IMPROVEMENTS IN STEAM-ENGINES.



CAIRD'S IMPROVEMENTS IN STEAM ENGINES.

MR. J. T. CAIRD, of Greenock, has obtained a patent for some improvements in steam engines, The invention, which is illustrated in the above engravings, relates to a novel arrangement and construction of certain mechanically operative details connected with the valvular apparatus or movements of steam engines, more particularly those of the oscillating class.

The improvements may be carried out under various modifications; but, according to one arrangement, as adapted specially to oscillating engines, the details are contrived as follows:—The working steam cylinder is formed or fitted with separate and distinct valve faces; two, for example, for the main working steam slide valves, and two for the expansion slide valves on the steam belt. These valve faces, and consequently their corresponding valves, are disposed two on each side of the main trunnion on which the cylinder oscillates, that is, there is one main steam slide valve and one expansion valve on each side. The expansion valve is placed nearest the trunnion, or, in other words, it is between the trunnion and the main steam slide valve, and it is worked by a double lever arm from the link hereinafter described. This arrangement of the valves forms a good balance, and it enables the expansion to be carried out in a much more effective manner than can be accomplished according to the usual plan. To a segmentally slotted bar or cross-head piece, similar to that ordinarily employed for the communication of the eccentric's motion to the main slide valves, without any derangement from the oscillatory action of the cylinder, there is attached at the centre a cranked stud. This stud is bolted in laterally, and is cranked upwards, terminating in a large eye. This eye is bored out horizontally to embrace a traversing bush, cylindrical in external form, but recessed laterally on each side, or formed with top and bottom shoulders to fit into the expansion lever link. This link is composed of two plain bars or curved segmental pieces bolted together, with a space between them for the traverse of the bush therein. It is from this stud as a centre that the motion of the eccentric is conveyed to the valve. One end of the link is jointed in the usual manner by a fixed stud to the lower end of the eccentric rod from the main shaft, and the link thus receives the vibratory action necessary for the operation of the valve. The opposite end of the link is similarly jointed to the lower end of a pendent radius rod or bar, the upper end of which is fitted with a ring to embrace a concentric collar or shoulder on the main shaft, or fixed to a stud placed as near the centre of the shaft as possible; thus this rod has no longitudinal traverse motion, and its lower end forms the fixed supporting centre for the link to work upon. This lower end is fitted with an adjusting screw, spindle, lever, and link movement or other adjusting arrangement, so that it can be set in or out from the main vertical centre line of the cylinder, and thus vary the effective throw of the link, and consequently alter the expansive action of the valve. This system of valve gear is applicable to all classes of steam engines and valvular apparatus, and it is available as well for the main slide valves as for separate expansion valves. The adjustable radius bar always keeps the centres correct, and forms a steady fulcrum for the link action, whilst its adjustment is so simple that the engines can be handled with much greater facility than heretofore.

A NEW RAILWAY SIGNAL.

TRAVELLERS on the Midland Railway, passing Kegworth, may have observed at that place a new signal which is likely to cause a revolution in railway signals. It consists of a clock, with a face four feet in diameter, placed on the top of a column fifteen feet high. Only a quarter of the clock is shown, which is formed of ground glass, with red figures 0.5.10.15., and has only one hand. Attached to the clock is a long rod connected with a treadle about sixteen feet long, which lies along the inside of one of the rails. On the train passing over the treadle it is depressed slightly by the wheel flange, and the clock hand is set at liberty and is so adjusted by a counterpoise that it turns to the figure 0. Immediately the train has passed over the hand begins again to mark the time up to 15 minutes, when it is stopped, thus indicating to the next train exactly how long up to 15 minutes the preceding train has passed the signal. The same clock works two faces, one for the up and one for the down line. The signal is illuminated at night. The simplicity of this signal is such that it is almost an impossibility for it to get out of order, and it is so arranged that a passing train takes off all pressure from

JEWSBURY'S APPARATUS FOR RAISING WEIGHTS.

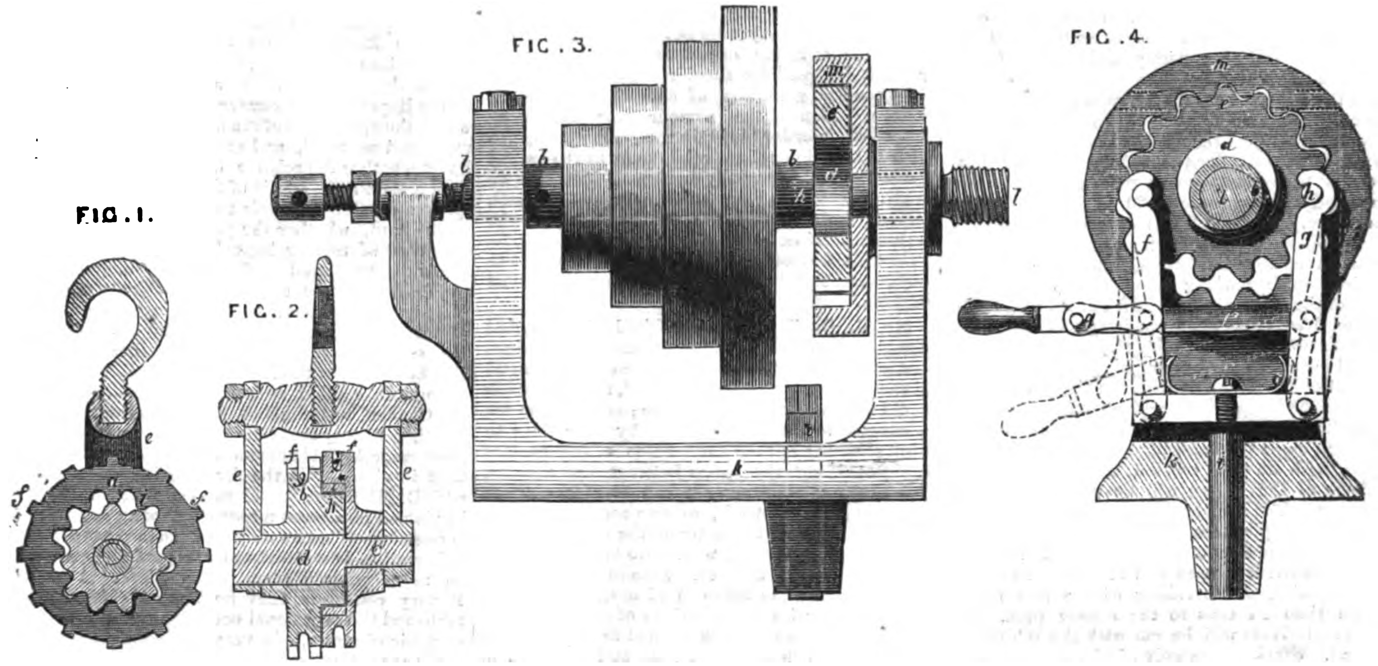


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

the clock, so that the great difficulty hitherto experienced in self-working signals is successfully overcome. The Midland Railway Company, who have erected the one above described, have every reason to be satisfied with the result of the experiment. It is calculated that when adopted double the number of night trains may be safely passed over the line that can be passed over now. There can be little doubt that it will prevent a great number of accidents from trains running into each other; and placed at mouths of tunnels will be of great service. The inventor of this ingenious contrivance is Mr. John King, lace manufacturer, Heanor.

JEWSBURY'S APPARATUS FOR RAISING WEIGHTS.

A PATENT has been obtained by Mr. J. Jewsbury, Kinver, Stafford, for improvements in machines for raising weights, which improvement may also be applied to lathes.

The invention consists in the application to machines for raising weights, and to lathes, of the mechanical arrangements hereinafter described, by which the motion communicated to a shaft or axis is reduced in speed and proportionately increased in force in a simpler manner than by the mechanical arrangements ordinarily employed for that purpose. A crab for raising weights may be constructed as follows:—On an axis turned by a winch or otherwise an excentric is fixed, he excentric carrying a pinion. The pinion is loose on the excentric, the square shoulders or pins on the pinion engage in slots in an oscillating plate or arms, the pinion hence has no rotary motion. The pinion is situated in and engages with an hollow toothed wheel having one or more teeth more than the pinion. On each rotation of the axis carrying the pinion the said pinion is carried round the hollow toothed wheel, and causes the toothed wheel to advance to the extent of one or more teeth. In order still further to increase the power of the machine, the arrangement described may be repeated, that is, the hollow toothed wheel may carry an axis, on the end of which is a second pinion incapable like the first of rotary motion. The second pinion engages with a second hollow toothed wheel, which carries a hollow axis working on the axis of the first hollow toothed wheel. The second toothed wheel advances to the extent of one or more teeth during one rotation of the first toothed wheel. The chain or rope by which the weight is to be lifted may be wound on the hollow axis of the second toothed wheel, or the axis may carry a pinion engaging with a rack.

Fig. 1 represents in transverse section a pulley for raising weights; Fig. 2 is a longitudinal vertical section of the pulley.

The pulley is made in two parts of the same diameter. The part *a* turns on the axis *c*, and the part *b* turns on the eccentric part *d* of the said axis; the said axis *c*, *d*, is fixed in the frame *e* of the pulley. On the periphery of each of the parts *a*, *b*, and near the faces thereof, projections or studs *f* are made in the direction of radii. In the middle of each part and between the studs or projections *f* a groove *g* is made as represented. The chain used with the pulley is temporarily fixed on the parts *a*, *b*, by each alternate link of the chain engaging between the studs or projections *f*, and in the grooves. On the inner face of the part *b* of the pulley a pinion *h* is situated, and in the face of the part *a* a hollow toothed wheel *i* is made, the said hollow toothed wheel *i* being provided with one tooth more than the pinion *h*. An endless chain passes over the parts *a*, *b*, in the following manner:—Commencing with the chain on the near side of the part *a*, the said chain passes over the top of the part *a*, descends on the distant side of the said part *a*, and descending to a distance below the pulley returns forming a loop in which a single pulley is placed, the single pulley being attached to the weight to be raised. The returning chain ascends on the near side of the part *b*, and passing over the top of the same descends on the distant side of the part *b*, and passing downwards below the pulley returns to the near side of the part *a*, the point from which the course of the chain was first described. By pulling one or other side of the hand loop the pulley is made to rotate. The action of the fixed eccentric *d* is to cause the pinion *h* to roll round within the hollow toothed wheel *i*, the teeth of the said pinion engaging during the rolling motion with the teeth of the hollow wheel *i*; but as the wheel *i* has one tooth more than the pinion *h*, the said pinion *h* performs a complete rotation during the time that the hollow toothed wheel *i* is performing a rotation less the length of one tooth. Hence the part *b* of the pulley advances one tooth upon the part *a* during each rotation, and the chain passing over the part *b* is consequently being paid out or drawn in somewhat faster than that part of the chain which passes over the part *a*. The pulley loop is thereby slowly lengthened or shortened, and the single pulley supported in it slowly raised or allowed slowly to descend. The action of the parts of the pulley differs in no essential respect from the action of corresponding parts in the crab already described. In the crab the first motion is given to the axis and eccentric, the pinion on the eccentric being prevented from rotating. In the pulley the first motion is given to the drum or pulley, the eccentric being fixed and the pinion rotating upon it.

Fig. 3 represents a side elevation of a lathe head constructed according to this invention, and fig. 4 is a section of the lathe head. On the hollow shaft *b*, carrying the speed pulley *c*, *c*, is placed an eccentric *d*, which carries the pinion *e*. The pinion is made incapable of rotation by the engagement of the slotted arms or levers *f*, *g*, with the pins *h* on the said pinion *e*. The stem *i*, to the top of which the arms or levers *f*, *g*, are jointed, rises or falls in the bed *k* of the lathe. On the end of the lathe spindle or shaft *l* is a hollow toothed wheel *m*, with which the pinion engages; the hollow toothed wheel having one more tooth than the pinion *e*. By the motion of the pulley shaft *b* the pinion *e* is carried round the hollow toothed wheel *m*, and the lathe shaft *l* made to advance through the distance of one tooth on each rotation of the said pulley shaft *b*, a slow rotary motion is thereby communicated to the said lathe shaft *l*. The lathe shaft *l* and pulley shaft *b* may be coupled together and made to rotate at the same speed by throwing the arms or levers *f*, *g*, out of gear with the pins *h*, and connecting the shafts together by means of the pin *n* passed through them, or in any other convenient way. The holding arms or levers *f*, *g*, are engaged with and disengaged from the pins *h*, *h*, of the pinion *e* in the following manner:—The arms or levers turn on centres and are pressed outwards when at liberty to move by the spring *o* between them. The lever *g* is jointed to the end of the lever *p*, and the lever *f* is jointed to the said lever *p* by means of the link *q*. The lever *p* is on one side and the link *q* on the other side of the arm or lever *f*. When the lever *p* and link *q* are in the positions represented, a pin is passed through them, and the said lever and link fastened together, and the levers *f*, *g*, thereby held in gear with the pins *h*, *h*. By removing the pin and depressing the lever *p* into the position indicated in dotted lines, the levers *f*, *g*, can turn on their centres, and are pressed outwards and disengaged from the pins *h* by the spring. The pinion *e* is then at liberty to rotate with the pulley shaft *b*.

ST. GEORGE'S BRIDGE, CAMBERWELL.

A NEW bridge is about to be built at Camberwell, over the Grand Surrey Canal. It will be erected partly on the site of the present bridge, to which, however, in extent, capacity, and design, it will be greatly superior.

As the approaches, Wells-street and George's-street, are at an angle with each other, it is proposed that the bridge should be placed slightly on the skew, in order that it may be made symmetrical with the approach roads; it is therefore designed with an angle of 83 deg., or 7 deg. on the skew. The width of the roadway, clear of the parapets, will be 40 ft., the pathways 8 ft. wide, paved with tooled York landings, and with an iron curb running along the edges. The span of the bridge will be 23 ft., supported by 15 arched iron ribs. The roadway will be formed of cast-iron cellular plates (Mallet's patent), bolted closely to the upper flanges of the supporting ribs. A handrail will run along the outer sides of the bridge; this will be of iron, wrought in a diagonal pattern, with ornamental bosses. At each angle of the bridge there will be a gas lamp, with an iron twisted stem. The entire surface of the bridge will be covered with asphaltum. The skewbacks, caps, and base mouldings of the pilasters, piers, and coping to the dwarf walls will be of Portland stone. The chief portion of the iron used will be the best wrought Staffordshire, not breaking with a less tensile strain than 24 tons to the square inch. The bolts and rivets will be cut with the Whitworth thread. Stock bricks only will be used throughout the entire work, and picked stocks for facings to the wing walls and abutments, neatly dressed off. The sheet piling, both beneath the bridge and in front of the wing walls, is, after being driven in, to remain permanently, as timber is found to be better than brickwork for barges to strike and roll against in the contracted part of the canal beneath the bridge. As the abutments of the proposed bridge are to be in a line with the present abutments, and will be an extension of the same, it is expected that the old foundations may be made available for the foundations of the new bridge. The works will be carried out so that a clear waterway of 17 ft. is left; and in order to interfere as little as possible with the traffic of the bridge, it will be built in halves —one-half being finished before the second half is commenced.

The estimated cost of the structure is from £1,000 to £1,100. It will be built at the expense of St. George's Vestry, Camberwell. The designer and engineer is Mr. C. Branfield, 10, Bridge-street, Westminster.

RECENT AMERICAN INVENTIONS.

AT a recent meeting of the Franklin Institute, Pennsylvania, Mr. Joseph Clay exhibited his patent air spring trusses. The pads consist of india-rubber hollow semi-spheres, distended with air and covered with cotton fabric; they are mounted upon a piece of leather, having the usual straps and buckles. The ball has sufficient elasticity to perform its office, and at the same time yield to an unusual pressure if brought upon it by accident; thus preventing bruising of the part in contact.

The Committee on Meetings presented the following articles:—A piece of the armour plate of the Whitney Battery, "Keokuk," punched through by a ball during the late attack upon Fort Sumter. It seems to have been struck by a nine-inch round shot, a portion of which was shown at the time. The iron is of good quality, showing fibres at line of rupture. The blow was not perpendicular, judging from the appearance of the piece, which resembles the bowl of a table spoon, with the pointed part rounded off. The back or converse part, where first struck, shows the stretching of the iron before rupture took place. The piece is evidently a part of the inner plate of turret, which is composed thus: first an inner plate of ½ in. thickness, upon which are placed, edgewise, bars of iron 1 in. thick by 4 in. wide, and 1¼ in. apart; the interstices being filled with yellow pine wood; upon these are placed three plates, each ⅞ in. thick. The whole is fastened with bolts of 1¼ in. diameter, passing between the bars, and riveted into countersunk holes. This battery was not intended to resist the action of heavy ordnance at short ranges, but was designed for shoal river service, where the guns are generally of comparatively small calibre. Hence, the armour was placed as described, in order to obtain the greatest strength with least weight of material, so as not to exceed a draft of 8 ft. when fully equipped. There is no doubt she was a very suitable vessel for such service, but entirely unfitted for the part she sustained against Fort Sumter, being nearer to its guns than any of the "Monitor" vessels, whose turrets have about twice the amount of material in them.

Mr. J. C. Garrigues exhibited his patented portable book-case, which is made in sections easily taken apart. The upright ends are hinged in the centre, so that, when folded, their length is equal to the breadth of the case; the shelves are connected to the upright ends by dovetails; to each shelf is attached the portion of the back of the case filling the space between the shelves. The case can be readily taken to pieces when necessary to remove it, as two screws only are used in each end of the top of the case to secure it to the upright ends, which are held in position by the dovetailed shelves. An additional advantage is, that when taken to pieces, by reversing two shelves, with their portions of the back, over each other, boxes can be formed for packing the books and for holding the ends and top piece of the case.

The Committee on Meetings exhibited a number of glass jars of several kinds, sealed by an elastic cap, the patent for which was recently issued to Messrs. Hartell and Letchworth, of that city. This improved cap consists of a rigid plate or disc, of metal or other material, with an annular flanch of gum elastic secured to the edge of the disc. By applying this cap to the mouth of any suitably sized vessel, and turning down the rubber flanch, the latter grasps the vessel with a contractile force sufficiently to hermetically seal the same, and preserve any substance within it from the action of the external air.

Another self-acting device of Mr. Hartell's was shown, as applied to jars containing peaches, pears, &c., which had been enclosed therein for over three years. The fruit was stated to have been placed in the jar as picked from the tree, without any other preparation than to cover it with cold water. To all appearances the articles preserved were as solid as when first picked.

A sketch illustrating an invention of Messrs. Stileman and Ellis, for smelting and melting iron, was shown. This consists in applying to a foundry cupola, or other furnace, a box, between the upper and rear side of which and the base of the cupola, is a pipe, which conducts the metal, as soon as melted, from the cupola to the box, the blast from the cupola passing into the box and out of an opening at the side. The object of the invention is to get rid of the slag and scoria which float on the top of the metal in the box, and are blown out of the opening at the side of the same by the blast, the pure metal being drawn from the tap opening at the bottom of the box. It was stated that by this invention, from old retorts, otherwise worthless, over 75 per cent. of iron might be obtained.

Mr. U. B. Vidal, of Philadelphia city, exhibited several coal oil lamps of his invention, the wick tube of which, above the base of the burner assumes a fan-shape, so that as the wick is raised the upper edge of the same is spread out to nearly double its former width. By this invention the oil carried up by the wick is distributed over so extended a surface that it is entirely consumed, and no portion can remain to clog the wick or run down the outside of the tube, to be evaporated and discharged into the air of the room, as is the case where a large supply of oil is constantly brought to a small burning surface. No chimney is needed with this lamp, which burns without smoke and with a clear flame.

METEOROLOGICAL OBSERVATIONS.

A COPY has been returned to Parliament of a correspondence between the Board of Trade and the Royal Society on the meteorological observations, telegraphy, and forecasts. The Secretary of the Board of Trade wrote in February last to the Royal Society concerning the new features which the operations of the meteorological department had assumed, and expressing an anxiety to know whether the science of meteorology is in such a state as to admit of the permanent reliable system of storm signals and daily weather forecasts; and, whether the progress and useful application of meteorological science will be more efficiently promoted by devoting the money voted by Parliament to the original objects contemplated, viz., the collection, tabulation, and discussion of meteorological phenomena, or by devoting it to the system of telegraphy and weather forecasts. The Secretary of the Royal Society, after the lapse of a month, replied, on behalf of the President and the Council, to the effect that they are assured by Admiral Fitzroy that the original objects for which the meteorological department was formed are still kept in view. "In the forewarning of storms," adds Dr. Sharpey, "much must as yet undoubtedly be viewed in a great measure tentative; but there is one class of cases on which such premonitory information is entitled to be regarded as resting on more assured scientific relations. Admiral Fitzroy considers that he has satisfactorily established the occasional occurence of storms of a cyclonic chracter, of a very limited diameter, not much exceeding perhaps that of the British islands themselves, and orignating in their vicinity. The practice of forewarning is specially suited to such storms. They are characterized by great violence and by frequent and rapid changes in the direction of the wind. The key to their comprehension is supplied by the telegraphic reports which convey to the central office a knowledge of the various simultaneous directions of the wind in different localities; and when once comprehended they are particulary suited for forewarning, inasmuch as, in its general course, the advance of the cyclone is steady in direction and moderate in rate. In connection with this subject the President and Council revert with satisfaction to a reply by Sir John Herschel to the Royal Commision on lights, buoys, and beacons, that 'the most important meteorological information which could be telegraphed would be information first received by telegraph of a cyclone actually in progress at a great distance, and working its way towards the locality. There is no doubt that the progress of a cyclone may be telegraphed, and might secure many a ship from danger, by forewarning.' It is obvious that this remark, which refers to the approach of a distant cyclone, is equally applicable to cyclones originating in or near our islands, the existence of which has been made known by the system of telegraphy which Admiral Fitzory has established. With respect to the 'forecasts of the state of the weather,' which are published in the newspapers, the President and Council learn from Admiral Fitzory that they really occasion no cost to Government, and scarcely fall, therefore, within the questions submitted for reply; moreover, the President and Council have no data whereon to rest a conclusion in regard to the degree of reliance to which these last-named forecasts may be entitled."

FLETCHER'S IMPROVEMENTS IN FORCE-PUMPS.

THE following improvement in force-pumps has been recently patented by Mr. F. Fletcher, of Birmingham.

In constructing or making lift or force pumps for the purposes of raising water out of deep wells, or for supplying cisterns on buildings, or for other purposes, to fix such pumps on solid planks of wood, and then to bolt or fix such plank against a wall or other support, or in cases where such pumps are fixed down in wells, to bolt or fasten them to a solid piece of wood placed either vertically or horizontally, as the case may require, and when a vessel for the

compression of air is used, to attach such vessel externally to what is technically called the chamber of the rising main, and it is usual to make such air vessel of copper.

In this invention the patentee dispenses with the solid plank of wood, and substitutes in the place thereof a hollow box or frame of iron, or other suitable material, on or against which box or frame the cylinder or barrel of the pump is fixed, and if the situation require it, the handle or other apparatus necessary for working the same; this hollow box or frame forms a vessel for the compression of air, by inserting or attaching the delivery pipe thereto, by which arrangement a continuous flow of water from the delivery pipe is obtained while the pump is at work.

MANCHESTER STEAM BOILER ASSOCIATION.

AT the last ordinary monthly meeting of the executive committee of this association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, June 30, 1863, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract :—

"During the past month there have been examined 340 engines—2 specially; 528 boilers—10 specially, 12 internally, 104 thoroughly, and 402 externally, in which the following defects have been found :—Fracture, 8 (2 dangerous); corrosion, 34 (3 dangerous); safety-valves out of order, 9; water-gauges ditto, 21; pressure-gauges ditto, 9; feed-apparatus ditto, 2; blow-out apparatus ditto, 35; fusible plugs ditto, 13; furnaces out of shape, 4 (2 dangerous); over-pressure, 2 (both dangerous); blistered plates, 3. Total, 140 (9 dangerous). Boilers without glass water-gauges, 8; without pressure-gauges, 2; without blow-out apparatus, 13; without back pressure-valves, 39.

"EXPLOSIONS.

"No. 10 Explosion.—The fact of this explosion having occurred was stated in last month's report, but no detailed particulars had then been received. It has since been ascertained that the boiler was a plain cylindrical egg-ended one, externally fired, and that the explosion was caused by rents commencing at the seams over the furnace, which has so frequently been found to be the case in this class of boiler, and called attention to in these reports. Two other explosions of a very similar character have happened during this month, particulars of which are given.

"Nine explosions have occurred during the last month, by which 11 persons have been killed and 21 others injured. One of these explosions, which resulted from collapse of the flue, and by which no injury was done either to persons or surrounding property, occurred to a boiler under the inspection of this association; while in the eight remaining cases not one of the boilers was under its care. Details will be found below. The following is the monthly tabular statement :—

"*Tabular Statement of Explosions.*

"From May 23rd, 1863, to June 26th, 1863, inclusive.

Progressive No. for 1863.	Date.	GENERAL DESCRIPTION OF BOILER.	Persons Killed.	Persons Injured.	Total.
11	May 29	Locomotive	1	1	2
12	May 30	Cylindrical egg-ended. Externally-fired ...	5	12	17
13	June 2	Upright furnace. Internally-fired ...	0	0	0
14	June 13	Details not yet ascer- ascertained	1	5	6
15	June 13	Ordinary single flue, or "Cornish." Internally-fired ...	0	0	0
16	June 14	Cylindrical egg-ended. Externally-fired.	1	0	1
17	June 15	Details not yet ascertained	2	3	5
18	June 15	Marine	1	...	1
19	June 26	Details not yet ascertained	0	0	0
		Total...........	11	21	32

"No. 11 explosion occurred to a boiler of a locomotive engine while running with a passenger-train. Between 50 and 60 persons were injured and 4 killed. This result was not occasioned, however, by the explosion only, but principally by the train running off the line. Whether the engine leaving the rails was the cause or the effect of the explosion, is an interesting question, and one now undergoing strict investigation. All the facts likely to prove of value to steam users generally, which may be elicited with regard to this explosion, will be given to the members of the association at the earliest opportunity after the close of the inquiry. The only injuries directly attributable to the explosion are those which happened to the engine-driver and fireman, both of whom were severely scalded, the latter having died in consequence.

"No. 12 explosion, from which 5 persons were killed and 12 others injured, took place at an iron-works. The boiler in question, which was not under the care of this association, was personally examined shortly after the explosion happened, and found to be of cylindrical egg-ended construction, having an internal flue of horse-shoe shape, both the inlet and outlet of which passed through the further end of the boiler, the remainder of the flue being quite independent of the shell, and thus not forming any longitudinal tie from front to back. The boiler was externally fired, the flame first passing underneath the shell, and then entering the flue at one leg of the horse-shoe, and escaping to the chimney through the other. The length of the shell was 28 ft., the diameter 8 ft. 6 in, and the thickness of the plates seven-sixteenths, while the blowing-off pressure was about 40 lb.

"The boiler had rent completely into two parts at the fourth transverse seam from the front end, the larger portion of the shell flying forwards in a straight line from its seat, turning a summersault in its course, and landing in a position quite the reverse of its original one; the egg-end pointing to the brickwork seating, and the open one from it. The smaller portion had flown to a much greater distance than the other, and not, as is usually the case, in a direction immediately opposite, but at right angles to it. A sister boiler working alongside, and connected to the one in question, was moved laterally, sufficiently so to disturb the brickwork seating and break the steam-pipes, though not to unseat it altogether.

"With regard to the cause of the explosion. The boiler was fifteen years old, the plates over the furnace had already been repaired, and it was stated that the seams at that part had been observed to be leaking only a quarter of an hour before the explosion took place; while in addition, the shell was found to be patched in several places, and the plates cracked from the rivet holes to the edge. It is concluded, therefore, on consideration of the circumstances, that the boiler could not have been in good condition, the correctness of which it is thought derives some corroboration from the fact, that the boiler alongside was found at the time of making this examination, to be also leaking at the seams over the furnace, and that considerably, although not under pressure. An examination of the fractures, as well as a consideration of the direction in which the parts had flown, led to the conclusion that the rent had commenced at a longitudinal seam of rivets extending for some two or three plates over the furnace. The rent ran along as far as this longitudinal seam extended, and when met by a plate crossing it, or 'breaking joint,' as it is termed, then developed into a transverse rent, and completely severed the shell in two. It is thought that the fact of this longitudinal rent in the furnace end of the shell, being situated on one side of the centre or 'keel line,' accounts for that portion having been blown laterally, and that the upward direction which it had evidently taken, had caused the summersault of the remaining and larger portion. The explosion therefore is attributed to the imperfect condition of the boiler, and although such defects would not be dangerous in a suitably-constructed, double-flued, or 'Lancashire' boiler, which is always internally fired, they are generally found to be fatal in those boilers which are fired externally; while in the present case the effect was aggravated by the fact of the seams of rivets over the fire being in line, and the diameter of the shell being as much as 8 ft. 6 in.

"No. 13 explosion, by which no one was injured or the surrounding property damaged, occurred to a boiler under the inspection of this association, the particulars of which are as follows.

"The boiler was an upright furnace one, working in connection with two others of similar construction to itself. It was heated by the flames passing off from a furnace employed in preparing heavy forgings; the flames passing through an internal tube in the centre of the boiler, which ran directly from the top to the bottom. The extreme height of this internal flue was 26 ft. 2 in., but it was not of one diameter throughout. In order to admit of a brickwork lining to guard the flue above water line, the upper part was made of a larger diameter than the remainder, and attached to it by a flanged plate which formed a 'set-off' or shelf on which the brickwork rested; again, the lower portion of the tube had a bell-mouth at the bottom, to afford an easy entrance for the flame. The length of the upper part was 11 ft. 4 in., and the diameter 3 ft. 3 in.; the length of the intermediate portion was 10 ft. 4 in., and the diameter 2 ft. 6 in.; while the length of the bell-mouth was 4 ft. 6 in., and the diameter, at the base, 3 ft., the thickness of the plates being three-eighths of an inch throughout, and the blowing-off pressure 55 lb.

"The explosion which did not in any way disturb the original position of the boiler, resulted from collapse of the internal flue tube, the collapse being confined to the intermediate portion just described, which it rent at about the middle of its length.

"A tube of such small dimensions as those just given, namely, only 10 ft. 6 in. in length, and 2 ft. 6 in. in diameter, made of plate three-eighths in thickness, if of good material and workmanship as this one was, would be amply sufficient for a pressure of 55 lb., if working under ordinary circumstances.* This would suggest the conclusion that the water supply had been allowed to run short, but no positive indications of the plates having been over-heated appeared upon examination, though this may, however, have taken place on previous occasions without its being known. On account of the height of these upright furnace boilers, the glass gauges became inaccessible, and the one in question was fitted with two gauge taps only carried down by means of syphon pipes to within reach from the floor. Thus the water could sink below the proper level without affording any external indication, and would consequently pass unknown, should the gauge taps be neglected. This may have happened without any immediate collapse of the tube taking place, although the flue would be materially weakened by it, and rendered liable to give way some time after in consequence. It is impossible to say whether the flue tube was getting out of shape or not, since the boiler had been in such constant work, that no opportunity was afforded the association of making an 'internal' and 'thorough' examination for upwards of three years. This may not, therefore, be an improper time for calling attention to the importance generally of having spare boilers, so that an ample opportunity may be afforded for examination, as well as for cleaning and repair. The boiler was found to be heavily incrusted with hard scale, which must considerably have tended to the overheating and weakening of the flue, to which these vertical boilers are always prone, from the tendency of the ascending steam to cling around the tube and prevent the contact of the water. The inaccessibility of the gauges and fittings of these vertical boilers, on account of their height, is another disadvantage connected with them, and indeed a thoroughly good and safe furnace boiler must still be considered as a desideratum.

"In conclusion, it may be repeated, that this association cannot hold itself responsible for the safe condition of the boilers of those members who do not conform to its rules, and afford it an opportunity of making a 'thorough' examination, every year, of each boiler under inspection. The three years which had been allowed to elapse in the present instance, and during which period the boiler was unceasingly and severely worked—being heated by the intense flames passing from a reverberatory furnace, coupled with the use of very sedimentary water—this, quite precluded the possibility of the association's keeping any check upon the condition of the boiler.

"No. 16 explosion happened at an ironworks, to an externally-fired boiler 40 ft. long, 8 ft. in diameter, made of plates seven-sixteenths of an inch thick. The shell of the boiler gave way immediately over the furnace, the fireman being scalded to death from the stream of hot water issuing from

NOTE.—Since writing the above it has been ascertained that this flue has been re-constructed of plates of precisely the same thickness as the old one, and that on submitting it to the hydraulic test it was found to sustain a pressure of 120 lb. per square inch without yielding in the slightest degree, although carefully gauged. This clearly shows that the flue did not collapse from the weakness of its original construction.

the rent. The boiler had been repaired at this part, by putting on a new plate two months previous to the explosion, and it was at this plate that the rent occurred.

"This boiler, which was not under the charge of this association, was not personally examined on the occurrence of the explosion, but an engineer who inspected it shortly after has kindly furnished the following particulars:—The plate ripped open through the solid metal in two places, the rents being about 15 in. long and 1 in. wide; while the parts surrounding it were a good deal cracked and the seams patched, so that the bottom of the boiler was evidently in a very defective state. The ruptured plate was about seven-sixteenths of an inch thick, and did not appear of very good quality, as if not thoroughly welded in rolling; but the fractures were not, properly speaking, 'blisters,' since the whole thickness of the plate had come down at once. In addition to the inferior character of the plate, the boiler was heavily coated with incrustation, and this had accumulated at the bottom for a depth of 3 in. just over the fracture, and extended for a space of 4 ft. by 2 ft. This mud had hardened so much that the water and steam ploughed but a small hole through it in rushing out. There can be little question that this coating of mud had kept the water away from the plate, and thus led to its becoming overheated, from which it gave way. There was plenty of water in the boiler at the time of the rupture.

"It will be clear that it is scarcely possible for such a cake of sediment to have formed upon the furnace crown of an internally-fired boiler, and also that an efficient blowing-out apparatus would have prevented the accumulation in a great measure, if not altogether, and thus that the explosion was due to the dangerous character common to all externally-fired boilers, coupled in this case with neglect.

"L. E. Fletcher, Chief Engineer.
"Offices—41, Corporation-street, Manchester."

Note.—Since the above report was in print, another explosion has happened, from which nine persons were killed and five others injured. The fragments of the exploded boiler have been personally examined, and particulars will be given in the next monthly report. The boiler in question was not under the inspection of this association.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—R. T., W. A., G. C., J. C. W., H. C. M.

W. K. (Canterbury).—We are not aware that any such demonstration has ever been published. We earnestly recommend our correspondent to refer to our abstracts of specifications, where he will find an almost weekly record of inventions which are intended to accomplish such a purpose, he will find the ominous "patent abandoned" follows as a matter of course. It is utterly impossible to create force, and we cannot do better than recommend "W. K." to put by his demonstration for a month, think no more of it for that time, and then look it over again. He will be sure to detect his error. We have answered this correspondent at some length, because the sum annually wasted in the pursuit of that myth, the perpetual motion, is positively lamentable.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In order to protect our new wood wheels from damp, we have up to the present time, when finished out of the hands of the maker, given them one coat of the best red paint, then filled up all screw heads with putty when dry; then given a second coat of red paint, and when dry sand-papered it all over, then given a coat of naptha varnish, and it is then ready for use. True, we like red paint better than any other, both for its body and colour, but the process is too long in having to wait of the two coats getting dry. What we want to know is, first—Can you give us any receipt to paint or varnish new wood wheels so as to protect them entirely from all damp; and, second, for them to have a very smooth surface, so as to draw out of the sand smooth, free, and easy. Of course, the freer they come out of the sand the smoother the casting.—Engineer.

Why paint your wooden patterns at all? We would recommend three or four coats of varnish made of the best shellac, dissolved in purified naptha; three coats of this should be dry in 12 hours; it is beautifully smooth, and will effectually keep out damp. Can our correspondents suggest something better?—[Ed. M. M.]

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

TWIN SCREW STEAMERS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I have observed with some interest the controversy which has recently been waged through your columns, and that of other scientific journals, in reference to the supposed originators of the proposition for the application of twin screws to steamships. It is not my intention to take part in that controversy, but justice demands that I should state a fact or two in reference to the subject of it.

In the winter of 1848-9, Mr. Joseph Apsey, a gentleman who at that time was in business for himself, in a rather humble way, as an engineer and machinist, near the Blackfriars-road, called upon me. He at the same time exhibited drawings which he had made of a steam-ship in which a screw was shown under each quarter. A model of the the screws in brass was also exhibited by him on the same occasion, and this had peculiar, and as I thought, excellent features about it. The screws were to be driven, he said, by separate engines in order to facilitate turning and steering the ship. Mr. Apsey persistently advocated his plans, and solicited my assistance in realising them. His wish was to fit up a boat with two screws and separate engines, and run her on the Thames. Like many other clever inventors, Mr. Apsey lacked the requisite funds for carrying out his designs; but I know he revealed them to many engineers besides myself, and who probably will corroborate what I assert.

It was simply want of money that prevented the twin screw system of Mr. Apsey from being practically tested so long back as the year 1849, and it seems to me that this fact ought to be made known. What has become of its author now I know not, and I am no advocate of the scheme. My own faith lies rather in the direction of the recently patented plan of Mr. Vaile for marine propulsion—that of feathering-floated chain-propellers. It is solely with a desire to "render unto Cæsar the things that are Cæsar's" that I have put forward Mr. Apsey's claims as the real originator of twin screws and separate engines.

I am, Sir, yours, &c.,
Joseph Newton.

Royal Mint, July 1, 1863.

Miscellanea.

The French Government have ordered a submarine cable from Messrs. Siemens and Co., to be laid from Oran, in Algeria, to Carthagena, in Spain. This is to supply the service formerly effected by the deep-sea cable from France to Algiers, which broke down at the end of last year, and has since been abandoned, from the impossibility of repairing its defects in deep water.

The iron-cased frigate "Solferino" now lies ready for sea in Cherbourg. She is described as a ship of war of most formidable proportions, armed with a spur of a very strange form. The spur is so arranged that it becomes part of the entire vessel, and any shock it has to support will be felt throughout the ship. The shaft of the screw is, by a very ingenious mechanical contrivance, protected from any injury in consequence of the shock caused by the spur. The shaft may recede in such case without causing any inconvenience.

A remarkable work has been accomplished at Worcester, Mass. The chimney-stack at the iron-works of Nathan Washburn, which is 100 ft. high, having in it 60,000 bricks and weighing 170 tons, was moved a distance of 150 ft., and turned partly round, without the slightest accident.

The introduction of machine-made bags dates subsequent to the Exhibition of 1851, and already all branches of trade are using them. The manufacture of this article is taking up a large share of the papermakers' attention. The great consumption of grey and brown paper is falling into the hands of manufacturers of machine paper bags. One of the large London works employed in making them, turns out 130,000 per day.

A successful experiment was made lately at Havre with a gun invented by Count d'Haudetot, for throwing a rope from the shore to a ship in distress. The rope was carried a distance of 240 yards by a shot weighing 10 lb. The inventor says that the greatest distance to which a rope has been thrown by a similar instrument is 200 yards, and that the shot used weighed 20 lb.

From information received from Quebec, we learn that the mineral wealth of Canada is slowly but surely and most satisfactorily becoming developed. It is something less than six years since the copper regions of Lower Canada first attracted attention, and we now find them filled with mining enterprize, drawn by the rich promise from Europe and the States, bringing abundant capital and giving employment to hundreds. The Acton mine, in the county of Bagot, was the first to which much attention was directed, and the success of the operations in regard to production and money value are supposed to be without parallel. Within three years after it was opened 490,000 dols. worth of ore had been obtained, and between 500 and 600 hands were employed in its working. The Harvey Hill Mines, in the county of Leeds, a large interest in which was held by citizens of Quebec, is, as we learn, a still more valuable property than that of Acton. These mines have been disposed of within the last few days to Boston capitalists for the sum of £50,000 sterling. 322 tons of this ore from the Harvey Hill Mine, sent to England, give an average of 38 per cent. This is a much higher percentage than is generally obtained, but we are informed that much of the ore raised from this mine is as high as 50 per cent.

Mr. Archibald Sturrock, the engineer of the Great Northern Railway Company, has just patented an invention, by which the power of locomotive engines is greatly increased, and at comparatively little cost. The tender is converted into an auxiliary power. Cylinders are placed underneath, and are supplied with steam by the boiler of the locomotive. There is no necessity for using this additional power except at pleasure, and on heavy gradients; but, by its aid, one-third more tonnage may be attached to a train than can be taken by the engines now running. With the apparatus in the tender, an engine, without any increase of heating surface, has been for a fortnight, and is now daily working over the Great Northern Railway from Doncaster to Peterborough, and dragging forty loaded coal trucks, when the most powerful ordinary engine can only take thirty.

The *Rangoon Gazette*, in speaking of a land telegraph from Rangoon to China, says:—Captain Sprye and his son propose to carry on the telegraph wires, by land, from Shway-Gyeen to Hong Kong, through Kiang-Tung, Kiang-Hung, Esmok, and the principal cities and towns of the Chu-Kiang, or Pearl River Valley; the estimated distance being 1,100 miles only. This line, when completed, would enable Hong Kong to correspond with Galle in ten hours; in less time, in fact, than it now takes the steamer to coal at either place. And thus the governments and merchants of India and England would receive seventeen days' later news from China than they now get; while the Hong Kong public would actually receive the English summary of intelligence before the departure of the China steamer with it from Galle. We have remarked, that from Shway-Gyeen to Hong Kong is a portion only of the Messrs. Sprye's project. A second division is to carry on the wires from that port, through Amoy, Foo-choo-foo, Ningpoo, and the principal cities and towns along the coast of China to Shanghai. The estimated distance of this extension is 850 miles, and the gain in time between Galle and Shanghai would be increased to 22 days. On the completion of this second division there will be a hopeful prospect of still further extending the line fron Shanghai to Pekin, throw Hankow, and Tien-tsin; and ultimately when modern invention shall perfect telegraphic cables, from Shanghai to Japan. A telegraph eastward, from Calcutta, confined to the limits of British Burman, can never pay, and will never achieve anything of real importance, politically or commercially; whilst by extending its wire onward, as proposed, to the opposite limits of China—the most populous and civilized country of the East—it must carry with it there our country's influence, be a powerful assistant to our own Home Government in its intercourse with the Governments of China and Japan, of daily service to the merchant communities of of England, India, and China, and would prove, we are surely not too sanguine in predicting commercially, a great success.

A meeting of the Geologists' Association will be held on Monday next, at 7 p.m., when E. Charlesworth, Esq., F.G.S., will read a Paper on "Ammonites," and Dr. Richardson will read a description of the Excursion to Dudley. The Paper on Ammonites will be illustrated by a fine series of fossils, to be exhibited by J. F. Collingwood, Esq., F.G.S.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 3188, 3195, 3197, 3207, 3220, 3224.
BOILERS AND FURNACES, 3181, 3182, 3194, 3196.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 3191, 3193, 3202, 3209, 3214, 3233.
SHIPS AND BOATS, including their fittings, 3231, 3235.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 3201, 3212, 3216.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 3192.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 3183, 3186, 3190, 3199, 3217, 3223, 3229.
BUILDINGS AND BUILDING MATERIALS, 3230, 3239.
LIGHTING, HEATING, AND VENTILATING, 3185, 3210, 3213, 3215, 3236.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 3198, 3200, 3203, 3205, 3206, 3208, 3211, 3218, 3222, 3225, 3226, 3227, 3228.
METALS, including apparatus for their manufacture, 3219.
CHEMISTRY AND PHOTOGRAPHY, 3221.
ELECTRICAL APPARATUS, 3189, 3237, 3240.
WARFARE, 3184, 3234.
LETTER-PRESS PRINTING—none.
MISCELLANEOUS, 3187, 3204, 3232, 3238.

3181. D. and D. AULD, jun. *Improvements in working furnaces and steam boilers, and in apparatus connected therewith.* Dated November 27, 1862.

This invention relates to the arrangement and construction of apparatus for regulating the supply of air to the furnaces of steam boilers; also to self-acting apparatus for supplying water to the boiler. The self-acting apparatus for supplying air to the furnace consists, under one modification, of a sliding panel arranged at the front of the furnace door, the back part of which is formed with openings similar to the arrangement of a Venetian blind. The sliding panel is connected to a chain, which is carried over a pulley arranged on the upper part of the boiler, and is attached to a bell crank or other suitable lever, by which it is connected to one of Auld's self-acting dampers, or other similar and suitable apparatus. In lieu of the arrangement of a sliding panel, a throttle or other suitable valve may be used instead, where such modification is found more convenient. When the pressure of the steam falls, the damper apparatus is brought into operation, and this being in connection with the sliding panel or other valve, is thereby raised so as to allow a larger supply of air to pass through the fuel, and thus increase the rate of combustion, as well as the generation of the steam. On the other hand, if the steam is generated too rapidly, the self-acting apparatus causes the damper and sliding panel, or its equivalent arrangement, to be lowered, and so check the combustion of the fuel. *Patent completed.*

3182. J. L. LINTON. *Improvements in the means of generating steam, and in the apparatus to be employed therein.* (A communication.) Dated November 27, 1862.

This invention consists—1, in the application of ignitable fluids, such as petroleum and other mineral oils or hydro-carbons, to the purpose of generating steam for boilers; and 2, in the apparatus to be employed in the combustion and utilization of the said fluids, in order to obtain and apply the resulting heat to such steam boilers, the object being to mix air with the vapours of the oil or ignitable fluid for the purpose of thoroughly consuming the same. *Patent abandoned.*

3183. D. VERKAMP and C. F. A. VAN TRIGT. *Improvements in the treatment of old manufactured fabrics in order to obtain useful fibrous products therefrom.* Dated November 27, 1862.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

3184. W. CLARK. *Improvements in the preservation of animal and vegetable substances.* (A communication.) Dated November 27, 1862.

This invention consists in the employment of a coating consisting either of vegetable tar heated to a temperature of 160 deg. to 180 deg. Fahr., or of varnish obtained from hydro-carburets. The patentee claims—the application of a coating to varnish substances previously prepared in a toxical or antiseptic solution, as described, in order to prevent the dissipation of the preservative matter when the said substances are to be exposed to the action of water. *Patent completed.*

3185. W. CLARK. *Improvements in gas burners.* (A communication.) Dated November 27, 1862.

This invention consists in regulating the amount of air supplied to the burner exactly to that which is necessary for proper combustion. This the inventor effects by means of taps, valves, or other similar apparatus, self-acting or otherwise, the burner being enclosed in a chamber to which the admission of air is regulated, as described. *Patent abandoned.*

3186. J. CARBONELL. *Improvements in preparing, manufacturing, and washing the paper pulp derived from the esparto plant.* Dated November 28, 1862.

This invention consists, mainly, in submitting the esparto plant to sundry washings and boilings in water containing salt of soda, quick lime, chloride of lime, sulphuric acid, and other chemicals. Special machinery is employed. *Patent abandoned.*

3187. W. A. WADDINGTON. *Improvements in machinery for cutting wood.* Dated November 28, 1862.

In carrying out this invention the wood to be cut is clamped or fixed on the sliding part of the surface of a bench. This sliding part receives motion by means of a horizontal shaft on which there is a pinion which takes into a rack on the under side of the sliding part of the bench. Motion is communicated to this horizontal shaft or axis by a screw or worm on an upright shaft, which takes into and drives a screw or worm wheel on the horizontal shaft. On the screw or worm shaft is a pulley or drum, which receives motion by a band or strap, driven by a pulley or drum on the driving shaft. Two upright shafts are used, each of which carries a rotating cutter, which, by preference, consists of three cutting blades of the shape or contour of the intended front for a pianoforte or other similar work. Each of the right cutter shafts is driven by a strap on a drum or pulley on the driving shaft. By this arrangement the wood to be cut, as it is moved by the sliding part of the bench, is presented progressively to the cutting blades of the rotating cutter, which is fixed on the upper end of each upright shaft, and above the surface of the top of the bench. *Patent abandoned.*

3188. J. T. CAIRD. *Improvements in steam engines.* Dated November 29, 1862.

The patentee claims—1, the application and use of expansion or cut-off valves, arranged on the steam belt, and by preference between the steam trunnions and ordinary slide valves of oscillating steam engines, as described in the specification, and shown in the drawings; 2, the systems or modes of arranging and constructing the gearing for actuating the expansion, or the slide valves of oscillating steam engines, for regulating the extent of motion of the same, so as to produce any required amount of expansion of the steam, as described in the specification and represented in the drawings. *Patent completed.*

3189. J. H. JOHNSON. *An apparatus for indicating the pressure of electric conductors in foreign bodies.* (A communication.) Dated November 28, 1862.

This peculiar apparatus consists, essentially, of a hollow sounding or testing rod, within which is placed, so as to be free to move to and fro, another rod, which, in all cases, is insulated completely from the outer tube or sounding rod. One pole of a battery is connected with the outer tube, and the other pole with the inner rod, and with either of these parts there is also connected, so as to be in the electric circuit, a small electric alarm bell or signal and galvanometer. The internal rod may either remain fixed to the tube, so that its lower extremity is always flush with the end of the tube, or it may, when not in action, be retained and held up away from the lower end of the tube by means of a spring catch or other convenient contrivance. If this apparatus be now inserted into a boring, pushed into sand, or submerged, the instant the extremity of the tube comes in contact with or strikes a resisting body, the resistance occasioned will effect the release of the inner rod, and cause it to descend until its extremity also comes in contact with the same body, and if such body be metallic or conductive of electricity, a circuit will instantly be established between the tube and the inner rod, through the contact therewith of the conductive medium, and a current of electricity will pass through the apparatus, ringing the bell, and indicating its presence on the galvanometer. *Patent completed.*

3190. F. BOECKE. *Improvements in sewing or uniting fabrics, and in the machinery or apparatus employed therein.* Dated November 28, 1862.

This invention relates to certain improvements upon what are commonly known as the Wheeler and Wilson and the British sewing machines, but they are also applicable to other sewing machines of the same character, or where the driving shaft is similarly placed. According to this invention, it is proposed to construct the bobbin or under thread case or shuttle of the Wheeler and Wilson, or the British sewing machine, with a raised conical or rounded boss or projection in the centre, on that side next which the needle works, a corresponding recess being made in the back of the hook when adapted to the Wheeler and Wilson machine to receive the projection on the inner side of the bobbin thread case or shuttle. By the aid of a thread case or shuttle fitted or formed with this projection a twisted chain stitch, having a second thread passing through the loops, may be produced in the Wheeler and Wilson, or in the British sewing machine, or in any other working on the same principle; or, if desired, the second or under thread may be dispensed with, in which case the machine will produce the twisted chain stitch from a single thread. The object of the projection in the side of the bobbin thread case or shuttle is to hold each one side of the loop of the needle thread until the point of the needle has passed down in front of it, so that, on the thread slipping over the projection, the loop will be round the needle, and, consequently, round the thread carried by the needle, thus forming the chain stitch. The operation is precisely the same when a second thread is used. *Patent completed.*

3191. J. CRESWELL and E. T. GREVES. *Improvements in the construction of hearses and funeral carriages.* Dated November 29, 1862.

In carrying out this invention the patentees construct a hearse with several compartments, the number found convenient being about twelve. The hearse is thus arranged:—In the fore part of the carriage over the front wheels are four compartments, two, one over the other, on either side; these are closed from the side of the hearse by suitable flap doors or drapery. On the rear part of the carriage are six similar compartments, so that the hearse is of a length to contain two coffins laid end to end; the compartments in the rear part of the carriage are closed at the back. By cranking the rear axle of the carriage, space is obtained for two more compartments hung from the body of the rear part of the carriage, thus making one hearse to contain twelve corpses in separate compartments. The improvements in funeral carriages consist in adapting one carriage to the conveyance of several parties of mourners separately; and with this view the patentees propose to construct a long carriage similar to an omnibus, but divided inside into two or more compartments, which can be closed by sliding doors or curtains, or in any other similar manner. *Patent completed.*

3192. S. J. BROWNING. *Improvements in machines to be employed in brewing.* Dated November 28, 1862.

This invention relates—1, to a machine for mashing and extracting; and, 2, to a combined refrigerating and cooling machine. The machine for mashing and extracting consists of a containing tun or vessel, in which the patentee fits an agitator furnished with inclined vertical and central horizontal blades, set spirally, which, when rotated, have a centripetal effect; that is, they drive the "goods" towards the centre. In order to obtain the greatest amount of extract from the "goods," he carries a pipe along the top, down the sides, and along the bottom of the agitator frame, and causes this pipe to communicate with inlet and outlet tubes. The pipe travels with the agitator, and thus maintains, or assists in maintaining, an even temperature throughout the tun. *Patent completed.*

3193. W. CLARK. *Improvements in the permanent way of railways.* (A communication.) Dated November 28, 1862.

The patentee claims—1, forming separate and independent sleepers of bridge or gutter iron, and also the application of double T-iron, with broad flanges, having suitable seats provided therein, for carrying double-headed rails, all as described; 2, the application of similar sleepers, connected together by means of ties underneath the sleepers, so as to afford a continuous firm bed for the same, all as described. 3, the application of undulated longitudinal plates, connected either by means of bridge iron of the same depth as the undulations of the plates, or by means of cross ties, as described; and also the various improvements in permanent way described. *Patent completed.*

3194. W. BUTLER and J. H. MUGFORD. *Improvements in spur-supporting rings for fixing plates, dishes, and other like articles in glost ovens.* Dated November 28, 1862.

This invention consists—1, in making the spur-supporting rings in the form of a circular ring, and in one piece, with three or more legs, which form admits of the plates or other earthenware articles being placed in closer proximity to the article underneath, and thus effecting a very considerable saving of room in the ovens; 2, in supporting the plates, saucers, or other articles on small moveable "points" or pyramidal spur pieces, placed upon or otherwise inserted in small eyelet holes or grooves, made for this purpose in the circular rim, and so as to be renewable at pleasure. *Patent completed.*

3195. J. F. DELANY and J. C. R. OKES. *Improvements in double cylinder expansive steam engines.* Dated November 28, 1862.

For the purposes of this invention, the slide valve of the high pressure cylinder of a double cylinder expansive steam engine is made with "lap" at each end, whilst the slide valve of the low pressure cylinder is made with no lap, or with as little lap as may be. These slide valves are to be worked or moved in any suitable manner, but so that the slide valve with the lap may precede the movement of the slide valve of the low pressure cylinder. *Patent completed.*

3196. J. ADAMS and W. C. WHITE. *Improvements in apparatus for boiling and evaporating.* Dated November 28, 1862.

This invention consists in certain improvements in apparatus suitable for the boiling and evaporating of solutions and liquids generally, and applicable to the manufacture of sugar preserves, sweetmeats, to preparations from drugs and chemicals, and many other useful purposes. The patentees construct a copper or other metal pan with a false bottom, and support the same by means of trunnions set in bearings on standards, and apply and fix to the interior of the pan a circular, spiral, or other form of tube, according to the shape of the pan or vessel. This tube is perforated with a number of small holes, and is supplied with steam from a boiler, or with hot air, which enters at one of the trunnions formed hollow for the purpose. The steam or hot air rushes into the hollow chamber of the pan by means of the hose-like apertures, and heats it to the required temperature for boiling or evaporating, according to the liquid, syrup, or solution to be treated. From the bottom and interior of the hollow pan a pipe ascends to the opposite trunnion, in order that the water of condensation may be forced up the pipe by the pressure of the steam, and driven out of the pan. *Patent completed.*

3197. A. DUDGEON. *Improvements in packing for various parts of steam and other engines and machinery.* Dated November 28, 1862.

This invention consists in plaiting cotton or other vegetable fibre into the form of a gasket, or otherwise twisting it, so as to form a rope. The patentee makes the rope with or without a core of elastic or non-elastic material. He either treats the vegetable fibre, or the manufactured gasket or rope, by steeping it in a vessel or vat containing a solution of silicate of potash, silicate of soda, stannate of soda, arseniate of soda, or of other chemical substances or compounds possessing similar properties, for enabling the material treated therewith to resist the action of great heat. The chemically treated gasket or rope he next steeps in a melted solution of paraffine, or of the preparations made therefrom, together with black lead, French chalk, or with an amalgam of mercury and tin, or any other amalgam possessing lubricating properties. When the gasket or rope has absorbed as much as it will take up of the solution next above described, he, in order to thoroughly incorporate the said materials with the rope or gasket, passes the rope

or gasket through or in between rollers, rotated by any convenient means, and the faces of these rollers are so constructed that they press or mould the prepared gasket or rope into the precise form which may be desired. *Patent completed.*

3198. W. E. GEDGE. *Improvements in the construction of clocks or timekeepers.* (A communication.) Dated November 29, 1862.

This invention consists—1, in the establishment of the striking work in the centre of the cage; 2, the suppression wheel, of the first wheel of the movement; 3, in replacing this the spindle, the pulley, the clockwork, and the weights, by a watch spring (No. 37) winding up three times in the hour by the action of the striking work; 4, in the suppression of the second wheel of the movement by means of a toothed gearing carried by the first wheel of the dialwork; 5, in setting the motor by the large hand; 6, in the suppression of the main detent, replaced by an extremely accurate and certain piece; 7, in the establishment of the species of anchor escapement forming part of this invention; 8, in the establishment of a stop-piece, forming the movement, to travel conjointly with the striking work; 9, in the supression of the key, by a counterweight; 10, in the establishment of a spring with four branches and reservoir. *Patent completed.*

3199. T. BLACKBURN and M. KNOWLES. *Improvements in looms for weaving.* Dated November 29, 1862.

Instead of the ordinary tappet for shedding in looms, the inventors, according to this invention, place upon the crank shaft a tappet so constructed as to lift only once for every two revolutions of the crank shaft, and by connecting a lever therefrom to the heald roller boss, or to any other fixing upon the heald roller, by means of straps or other suitable means, they raise or depress the healds, and thereby obtain the shed; and at the same time, by placing another lever in a vertical position, they are enabled to regulate a fixing on the picking stick shaft, so that a boss or projection fixed upon the fly-wheel would, in working, come in contact with the said fixing on the picking stick shaft alternately at the opposite side of the loom, thereby giving motion to the picking stick and throwing or picking the shuttle. Instead of the ordinary fixings for tappets and wheels for working, so as to keep proper time, they make a boss, on the face of which they cut teeth at uniform pitches, and by casting corresponding teeth on the boss of the wheels or tappets, and then attaching such bosses firmly on the shaft, they can, by means of a nut, force the wheels or tappets against such fixed boss at any given angle, regulating thereby the time of shedding and picking. *Patent abandoned.*

3200. F. G. TAYLOR. *Improvements in washing machines.* Dated November 29, 1862.

In carrying out this invention, the patentee employs a box or vessel having a part of its bottom made a segment of a circle, and another part an inclined plane, with a corrugated washing plate or board attached to it. He places in the interior of the box a squeezer or rubber, consisting of a number of horizontal slabs or boards, separated from each other at short intervals, and connected to arms or levers working in suitable bearings. To the sides of the box he hinges a board having vertical ribs in front, and acted upon by springs at the back, so that it shall have a re-acting action after pressure has been exerted upon it. The horizontal boards of the squeezer or rubber and the vertical ribs of the hinged board are either plain or covered with india rubber, as may be required, and the arms or levers for working the squeezer are either moved to and fro directly by hand or by means of eccentrics or cranks on a revolving shaft driven by hand or power. The box or vessel is supplied with water or a washing liquid, and the clothes or fabrics to be washed are placed against the hinged board, and the squeezer or rubber is repeatedly pressed against them, causing the position of the clothes to be continually changed. Above the hinged board there is a top board so inclined that the water or liquor, when it is pressed out of the fabrics, is returned upon them with increased force, without any additional labour, thus producing as nearly as possible the effect of rubbing and changing by human hands. *Patent completed.*

3201. J. CROMPTON. *Improvements in machinery or apparatus for ploughing, harrowing, clearing, and drilling land.* Dated November 29, 1862.

This invention consists of an improved arrangement and combination of a portable steam engine, with ploughs, scarifers, harrows, and other agricultural machines, and also revolving cutters, driving pulleys, and a crane, the details of which we cannot give space to here. *Patent abandoned.*

3202. T. LLOYD. *Improvements in, and applicable to, the wheels of vehicles.* Dated November 29, 1862.

This invention relates to improvements in the wheels of vehicles with the view to render them suitable for use on both railways or tramways and common roads; and also to the application of parts of such improvements to wheels now in use, or others similar thereto, in order to render them suitable for the same purposes or uses, the chief object of the invention being the production of a simple self-acting arrangement of parts, unlikely to get out of order, capable of thoroughly guiding the wheels of the omnibus, or other carriage, when bearing on the rails or trams, and offering a minimum of resistance when used on common roads, and when moving or passing on to or off from the rails or trams. *Patent abandoned.*

3203. T. EVANS. *Improvements in antigrophilos.* Dated November 29, 1862.

This invention consists in forming an antigrophilo, or eknemedia, of two parts, in such a manner that the upper part may be removed from the lower part, which latter can then be used as a gaiter, legging, or splatterdash. *Patent completed.*

3204. W. CLARK. *An improved machine for cutting corks and other stoppers.* (A communication.) Dated November 29, 1862.

The object of this invention is to obtain a machine for cutting corks for stoppers, which will perform the work rapidly and be capable of being adjusted readily, so as to cut the corks of cylindrical or taper form, as may be desired, and of any required degree of taper and size. The invention has also for its object a simple and automatically operating means for clamping and holding the corks to be cut. To these ends the invention consists in the employment or use of a tilting frame or arms provided with one or more arbors, which are rotated or thrown in and out of gear by the tilting movement of the frame, the latter being operated by the cutter shaft, and the arbor or arbors provided with clamps or holders, which are also operated by the tilting of the arbor frame, the above parts being also used in connection with feeders, also self operating, and a rotating circular cutter, all arranged. *Patent completed.*

3205. F. VACHER. *Improvements in ornamenting playing cards.* Dated November 29, 1862.

In carrying out this invention, the patentee proposes to take the packs of cards, after they have been completed by the ordinary processes of manufacture, to place them in a suitable press, and to scrape their edges in order to produce a smooth surface thereon, after which the edges are to be sized, and then glazed, or treated with albumen, and covered with gold or silver leaf, after which the surfaces are to be burnished. He also proposes to apply bronzes in powder or leaf of any desired colour to the edges of the packs after the requisite adhesive preparation. The edges may then be burnished. The bronze may be of a variegated colour or mixture. He also proposes to ornament the edges of the cards by colouring them in order to present an uniform body colour, or a variegated or sprinkled surface, which may then be burnished in the ordinary way. *Patent abandoned.*

3206. J. C. ROBERTSON and W. C. WHITE. *An improved tap or cock.* Dated November 29, 1862.

This invention consists of an improved tap or cock, the object of which is to render it self-closing, in order to prevent the escape or waste of the contents of a cask or barrel, or of water from ordinary household taps, or of any fluid through accidental circumstances, or negligence in leaving the tap or cock open or turned on. The patentees enlarge the upper part of the plug holder of the tap, so as to form a circular chamber therein, in which they place a helical spring, either of flat steel similar to a watch spring, or of round wire, and fix the same by means of a stop or stud. The plug of the tap is furnished with a similar stop or stud taking into a slot cut in the other end of the helical spring, or in the case of round wire taking into a ring formed by the twining over the end of the wire. A moveable cap encloses the top of the chamber, and the under surface of this cap has fixed or soldered thereto a small projection corresponding with a stud on the top of the enlarged surface of the plug contained in the chamber. *Patent completed.*

3207. H. MOULE. *Improvements in locomotive engines, and in apparatus for generating steam for steam engines.* Dated November 29, 1862.

In constructing a locomotive or other engine according to this invention, the patentee makes the fire box and ash pit of the engine of suitable dimensions. The bottom and sides of the ash pit are closed water-tight, in order to its containing water below the fire bars. At the sides of the ash pit openings are formed for the admission of air to the fire. Over these openings slides or covers are used, in order to regulate the admission of air; and when desired to shut off the supply of air altogether, a steam pipe is applied between the ash pit and the steam boiler, in order that steam may be admitted to the ash pit. On the steam pipe is a cock or valve by which the supply of steam to the ash pit may be regulated or shut off. Into the ash pit a mixture of oil or oily and fatty matters mixed with powdered coal is to be introduced, and a supply of water is to be constantly kept up in the ash pit, so as to touch the fire bars, or to come as near thereto as may be. On the fire bars alternate layers of coal or coke and chalk, limestone or lime, are to be placed, sufficient to fill the fire box to the required height. Or the fuel and chalk limestone or lime may be mixed before introducing them into the fire box. The fire is to be lighted, air being admitted freely at the openings at the sides of the fire box or ash pit. When the fire is well ignited, steam may be admitted into the ash pit from the steam boiler, and the admission of air may generally be reduced. *Patent completed.*

3208. D. SUTTON. *Improvements in apparatus for washing linen and other fabrics and garments.* Dated November 29, 1862.

For the purposes of this invention a vessel is used, by preference of a rectangular form, with a flat bottom suitably constructed to admit of the vessel being rocked to and fro thereon. The top of the vessel is closed with a cover, which has an opening in the middle. On the four sides and bottom are fixed numerous semi-spherical projections; transversely across the upper part of the vessel is an axis, either plain or threaded towards the ends—so as to obtain a to-and-fro motion, as well as a rotating one—on which are four or other suitable number of floats or paddles, and there are also two other axes transversely across the vessel, having each four or other suitable number of floats or blades. These axes are preferred to be fixed near the bottom, and transversely of the vessel is fixed a half round or other shaped bar, with numerous semi-spherical projections fixed on the upper rounded surface. The lower inner angles of the vessel are filled, and have similar projections fixed thereon to those above-mentioned. At the upper part and at one end of the vessel, there are fixed two uprights, which are connected together at their upper ends by a bar which is used as a handle to communicate a rocking motion to the vessel. *Patent completed.*

3209. J. ANDERSON. *Improvements in the manufactures of the tyres of railway wheels, and rails, switches, and crossings of railways.* Dated November 29, 1862.

This invention consists in heating the tyres of railway wheels, and also the rails, switches, and crossings of railways when made of steel or carbonized iron, to a bright red heat, and quenching or cooling the same by immersion in oil. *Patent completed.*

3210. R. K. PENSON. *Improvements in apparatus used for warming railway carriages.* (A communication.) Dated November 29, 1862.

For the purposes of this invention, a warmer is placed between the seats, and in a position to come under the feet of the passengers. It is preferred that this warmer should consist of a flat tubular chamber, but the section and form of the warmer may be varied. A portion of the funnel or chimney of the locomotive engine is partitioned off so as to produce a compartment open at the bottom to intercept part of the steam from the steam cylinders. This compartment has a door or cover at the upper part, which, when open, allows all the steam to rise up through the funnel or chimney into the open air, without being conducted into the warming apparatus fixed in the passenger carriages. A steam pipe is connected to this compartment in the chimney or funnel, by which the intercepted portion of the steam is conducted to the warming apparatus in the passenger carriages. *Patent abandoned.*

3211. M. HENRY. *Improvements in the manufacture of leather.* (A communication.) Dated November 29, 1862.

This invention relates to a mode of treating tanned skins and hides before they are curried, and it has for its object to render them thicker, stronger, and more durable, and to improve their quality. For this purpose the tanned skins or hides are treated with chondrine, glutine, or other proteic and gelatinous matters, or with substances congeneric or kindred thereto, employed by preference in combination with neutral salts, or with a metallic oxide of antimony, cobalt, cadmium, bismuth, tin, nickel, lead, or zinc. An agent or composition for the purposes of this invention is manufactured by combining gelatine, glycerine, and animal albumen with a neutral salt, or with one of the oxides before mentioned. *Patent completed.*

3212. H. L. EMERY. *Improvements in threshing machines.* Dated December 1, 1862.

This invention consists in the use, peculiar arrangement, and novel construction of an endless band of cells or boxes for receiving the grain as it is discharged from the threshing cylinder; in the employment and novel construction of a revolving rake for the purpose of accelerating the movement of the straw after it has passed the said cylinder, and completing the separation of the grain from the straw; in the novel device for separating the grain from the chaff, consisting of a perforated riddle with serrated longitudinal ledges for supporting and carrying forward the straw, and one or more sets of agitating fingers operated for the vibration of the riddle; in giving the requisite movements to the perforated riddle, the grain board, and the sieve box by means of a single swing lever upon each side of the machine, actuated by connecting rods from the fan shaft; in the use of a flue extending from the front of the threshing cylinder, and communicating with the straw chamber for the purpose of creating a draught by suction, thereby carrying away the dust, and in forming and combining other parts with the above so as to secure compactness and cheapness in construction and economy in operating the machine. *Patent completed.*

3213. P. BOURNE. *Improvements in miners' lamps.* Dated December 1, 1862.

This invention consists in means for extinguishing the light of the lamp in the act of opening the lamp, and before the gauze covering can be removed from the lamp. For this purpose the inventor attaches to the lamp near to the wickholder an apparatus consisting of one or more levers, mounted on a suitable fulcrum, bearing, or bearings, and which apparatus is capable of being depressed on the wick by the act of removing the wire gauze covering. This apparatus is by the action of a suitable spring or springs, or by the weight of the short end of the lever or levers aforesaid, or by both of such means, kept out of the way of the ignited wick so long as the gauze covering remains on the lamp, or when the gauze covering is being placed on the lamp, but as soon as any attempt is made to remove the gauze covering, a small projecting piece (or pieces) attached to the mounting of the gauze covering is forced under the short arm of the lever (or of each of the levers if more than one), which short arm is thereby, and by the unscrewing of the gauze covering, elevated, and thus the other end of such lever (or levers) is depressed on the wick, and so the wick is pressed down and the light becomes extinguished. *Patent abandoned.*

3214. G. F. GRIFFIN. *Improvements in the permanent way of railways.* Dated December 1, 1862.

These improvements consist in lowering the rail into the body of the sleepers, using the curve or lateral arch of the sleeper to support the rail on one side, and forming jaws or chair-arms to support it on the other, by which means the patentee obtains greater strength and a larger bearing surface to prevent lamination of the rail. Further, the keys being placed inside, should one accidentally become misplaced, there would be no danger of the rail getting out of gauge. The improvements further consist in recessing wood the whole length of the sleepers under the rail, and placing wood in recesses in the jaws or chair-arms of the sleeper described in the specification of a previous patent granted to the patentee (No. 1,843) in the year 1861, especially recessing wood in the lateral arch above mentioned, and in the keys in such manner that the wood assists in supporting the rail under its head. The key is itself supported on a shoulder cast on the inside of the jaw, and, therefore, cannot be placed downwards. Where wood is not used the rail is supported by the lateral arch itself. *Patent completed.*

3215. T. WALLER. *Improvements in stoves.* Dated December 1, 1862.

The object of this invention is to enable the fire space in stoves to be contracted or to be opened to its fullest extent at will, and this without affecting any other part of the stove beyond the fire space. The invention consists in hinging or connecting the cheeks of that part of the stove comprising the fire space to the back in such manner that they may be moved towards each other to any extent desired, in order to lessen the space for fuel, and again moved from each other to the full extent of the fire space by in-

serting a poker or other tool into a long ring or hole formed on or in the cheeks. In order to prevent any material falling behind and obstructing the motion of the cheeks, the patentee boxes them. *Patent completed.*

3216. J. IRWIN. *An improved machinery for cultivating land.* Dated December 1, 1862.

This machine is designed, principally, to give the effect of ploughing and cross cultivating at one operation, but it may be used also with advantage for removing "twitch" or "couch grass" and weeds from land, and for manuring. The machine consists, principally, of a central frame, supported upon two wheels (about 3 or 4 ft. in diameter), and having a hinged frame at back and front, provided with a guide wheel fitted with a socket joint and a guide lever. The hinged frames have each two cross bars, the first carrying five coulters, and the second four shares or "shell boards." These frames are hinged or jointed to the central frame of the machine, and provided with a lever or other suitable mechanism, so that either frame can be raised whilst the other is lowered. *Patent completed.*

3217. R. FLUDE. *Improvements in looms for weaving narrow fabrics.* Dated December 1, 1862.

This invention relates to the means employed for driving the shuttles in looms for weaving narrow fabrics, and consists in the employment of one shuttle driver, with two upright levers for each shuttle mounted upon it; the upper ends of such levers carry pegs which enter holes in the front of the shuttle (one at either end), or the pegs may be fixed in the shuttles, and the levers be provided with holes or slots taking thereon. One or other of the driving pegs and levers is always in connection with the shuttle, which connection may be utilized to prevent the shuttle dropping in front, and which, therefore, in such case may be shorter than the shuttles usually employed. *Patent completed.*

3218. J. COPPARD. *An appliance or appliances for horse shoes, to produce the effect of what is termed roughing.* Dated December 1, 1862.

In carrying out this invention, the inventor makes what he terms a clamp of any suitable metal, of size and shape adapted to the toe of a horse-shoe, so that one part shall fit in between the shoe and the hoof at the toe, or be otherwise secured at this part of the clamp, the other part being turned up in front with flanges, eyes, or catches, and be further secured to the hoof by a strap or india-rubber band passed round the same, and binding the clamp finally thereto. This clamp is to have projections or a roughened surface, so as to give the requisite foot-hold, and the roughened parts may be of steel or hard metal, and may be in separate pieces, which can be inserted and removed as desired, packing being then introduced between the horse's hoof and the clamp. *Patent abandoned.*

3219. J. ROMER. *Improvements in manufacture of bullion wire and metallic fine-drawn wire.* Dated December 1, 1862.

This invention consists in manufacturing bullion and other wire, either of gold, silver, silver gilt, steel, iron, and other metals or alloys, by drawing them through or between diamonds, rubies, sapphires, topazes, crysolites, garnets, or any other oriental or hard stones. *Patent completed.*

3220. W. CLARK. *An improved apparatus applicable as a pump, water-meter, hydraulic motor, or a steam engine.* (A communication.) Dated December 1, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3221. P. W. REUTER. *The preparation of a new compound to be used for dyeing and printing purposes.* (A communication.) Dated December 1, 1862.

This invention consists in the preparation of a compound for producing a brown colour on wools, by mixing oxide of lead, or other compounds of lead, with lime, potash, carbonate of potash, soda, carbonate of soda, baryta, magnesia, strantia, or other similar substances, which, on being mixed with water, will form an alkaline solution of oxide of lead. *Patent completed.*

3222. E. D. JOHNSON. *Improvements in pocket watches.* Dated December 1, 1862.

The object of the first of these improvements is to construct what is known as the blind man's watch, or a watch which will indicate the time in the dark by the touch, without materially interfering with the movement or mechanism of the watch, or with the external appearance of the watch. In carrying out this object, the patentee arranges a train of wheels on the upper plate of the watch, the last wheel of which shall be situate in the centre of the watch, and revolve once in every twelve hours. This wheel he so constructs or fits that it shall present an obstruction to a catch or stop carried by a moveable disc forming a false back to the case. This catch or stop is so arranged that, when the disc is moved round in one direction, the catch will strike against the obstruction, and the further movement of the disc will be thereby arrested, but when moved in the opposite direction, the obstruction will not be presented. By arresting this disc or moveable portion of the case the position of the hour hand will be ascertained, a stud being provided on the exterior of the face of the disc to act as an indicator, and a series of studs representing the position of the hours on the dial being inserted in the rim of the watch case. *Patent completed.*

3223. B. OLDFIELD. *Improvements in looms.* Dated December 1, 1862.

We cannot here devote space to the details of this invention. *Patent completed.*

3224. A. V. NEWTON. *Improvements in the construction of steam and other vessels.* (A communication.) Dated December 1, 1862.

This invention relates to the construction of vessels of war and other ships by covering the framing with a material that will form perfectly water-tight joints, present great resistance to, and will not splinter by, the concussion of shot or shell, and will withal be materially lighter than plate iron. The following is the mode of preparing this plating or covering material:—The commonest paper pulp, such as that of the cheapest straw board, is mixed with a thin solution of marine glue (which is insoluble in water, and unchangeable by time or temperature), or with any other gum or resin suitable for insuring the firm adhesion of the pulp fibres. This compound is compressed in moulds to form sheets or slabs, say 10 ft. square and 1 ft. thick, until it attains the hardness of oak, or even a greater degree of hardness. Before the sheets or slabs are dry and set, they are to be twisted to the forms required to suit the various parts of the hull. Thus provided with suitably shaped slabs, the shell, skin, or covering of the ship may be rapidly built up, two or more thicknesses of the sheets or slabs being used the one to overlap the other, and break joints in all ways. These layers of covering material are to be both bolted and glued together to make a firm compact mass. *Patent completed.*

3225. H. TWELVETREES. *Improvements in apparatus for cleaning knives, forks, and boots.* Dated December 2, 1862.

For cleaning boots according to this invention, the inventor employs a small wood or metal frame, in form something like a table, and immediately under the top at one or both sides he mounts a shaft containing one or more circular brushes. These brushes may be separate and fixed upon the shaft by wedge or other means, or by preference they are part of the wood shaft, and the bristles put therein to form the brushes. In the centre of the table underneath the top he disposes a flat piece of wood perpendicularly, terminating at the bottom with a small shelf, and by this means the dust from the bolts are prevented being scattered about. Within the frame of the table underneath the brushes he disposes a fly-wheel and treadle, communicating by means of a strap or cord with a small pulley upon the brush shaft for giving rapid motion thereto. *Patent abandoned.*

3226. H. TWELVETREES. *An improved sawing, filing, working, and turning apparatus.* Dated December 2, 1862.

We cannot here quote the details of this invention. *Patent abandoned.*

3227. H. TWELVETREES. *Improvements in washing, wringing, and mangling machines.* Dated December 2, 1862.

We cannot here quote the details of this invention. *Patent abandoned.*

3228. P. BRASSERT. *Improvements in apparatus for saving life and property in cases of fire or burglary.* Dated December 2, 1862.

The apparatus, the subject of this invention, consists of a wicker-work basket, which the inventor makes of a convenient size to contain the other requisities and parts of the improved apparatus; as also to be suitable for an ottoman or seat. For this purpose, and to render the basket more or less ornamental, he covers it in any suitable material according to the position or to the room in which it is to be placed. He prefers to place it close up to the window. He places in the basket (which has a lid to lift up easily) a rope ladder, by preference of light wire cord, and with wood or metal rounds or steps. He also attaches to the top edge of the basket a double cord of a length according to the height of the house, and in the bottom of the basket he fixes an upright iron standard, with a strong hook at the top nearly level with the top of the basket, and near the same side as that at which the double cord before mentioned is attached. He fixes a strong hook inside the window sill, or in the wall, to which hook the rope ladder may be readily hooked, it having a suitable eye for the purpose. *Patent abandoned.*

3229. J. and J. CRAVEN and J. ROBINSON. *Improvements in looms for weaving.* Dated December 2, 1862.

This invention relates to circular or other change shuttle-box looms, and the improvements consist in a means or method of stopping the shuttle at the proper place in the box, so as not to prevent the free movement or changes of the boxes at the time required. *Patent completed.*

3230. G. F. BLUMBERG. *Producing designs in or on glass.* Dated December 2, 1862.

The object of this invention is the production of ornamental glass tiles or quarries, to be used for the purposes for which the well-known Dutch tile is used, and also for paving or for lining surfaces where an ornamental, as well as solid substance, impervious to damp or other corrosion, is required. The patentee makes the tile of any size that may be desired, from the square of 6 in. or less to the ordinary size of foot paving, and of any shape, and of forms permitting the tiles or quarries to fit, or, as it were, dovetail into each other. He manufactures tiles or quarries of glass of any form or dimension, producing thereon a design or designs of any nature or description. To effect this he prefers to employ a mould made either of steel, iron, brass, copper, or other suitable metal or amalgam capable of taking a high polish, as he prefers to use a mould free from all irregularities and of plane polished surface. If the tiles, quarries, or slabs be of large size, a casting-table may be used, and the cavities for the designs made by a roller prepared for that purpose. *Patent completed.*

3231. J. WHEATLEY. *Improvements in the construction of ships-of-war, and in the manufacture of armour plates for ships, forts, and batteries.* Dated December 2, 1862.

For the purposes of this invention, in constructing a ship-of-war, the patentee forms the bow with a sharp projecting grab or crab bow, at an angle of about 25 deg. with the keel, and propels the vessel by paddle-wheels and screw, or by screws, the wheels when used working independently, so as to steer the vessel thereby. The rudder is to be supported by chocks acting like a common vice. In order to be able to mount guns of large calibre and power (say 13 in. bore, and 20 tons weight) in or near the centre of the vessel, pointing in a line with the keel, he constructs a glacis plated over with armour plates, and over the whole fore part of the vessel and extending to the front of the paddle-boxes. Another part of the invention consists in a mode of manufacturing armour plates, for which purpose the armour plates are to be rolled or formed with external parallel projecting ribs or lattice-work, at a distance apart less than the diameter of a shot or projectile which would be thrown against a ship, fort, or battery, protected or coated with armour plates, with the knowledge that the same would pass through the plating if of the ordinary construction. *Patent completed.*

3232. T. COOK. *Improvements in envelope folding machinery.* Dated December 2, 1862.

This invention consists in applying to such machinery apparatus arranged as hereinafter described for collecting the envelopes after they have been folded. A trough or slide is placed below the box in which the envelope has been folded, so that the envelope drops down this trough into a frame. A slide worked by a lever then carries the envelope over a grating having the ends open on one side. At each operation a lever or rake, having fingers which will pass between the bars of the grating, lifts the envelope up, carrying it into a trough of a suitable size. By this raising of the lever another envelope is allowed to be passed underneath this last mentioned lever or rake ready for it to lift at the succeeding operation. *Patent completed.*

3233. G. T. BOUSFIELD. *Improvements in forming the permanent way of railways.* (A communication.) Dated December 2, 1862.

For the purposes of this invention double T or H angle iron is used as sleepers or transverse bearers, in place of those heretofore employed, and also when continuous bearers are used. These forms of sleepers or bearers are employed whether chairs or other means of fixing the rails to the sleepers or bearers are resorted to. In forming a permanent way according to this invention, the sleepers or bearers are usually placed transversely across the railway, and the rails are fixed by bolts and nuts to the transverse sleepers or bearers. The chairs may be either fixed directly to the sleepers or bearers, or wood, or other suitable packing, may be interposed between the under surfaces of the chairs and the upper surface of the web which comes between the flanges of the double T or H angle iron of the bearers or sleepers, which are laid in a horizontal position on the earth. *Patent abandoned.*

3234. G. T. BOUSFIELD. *Improvements in apparatus for discharging guns or ordnance.* (A communication.) Dated December 2, 1862.

This invention consists in the employment upon the exterior of the gun of certain devices which enclose the vent and primer with sufficient strength to retain the gases of the discharge, and which can be readily removed and replaced to permit all the operations of loading and priming, or to enable the vent to be used in the usual manner in case of accident to the vent stopper, or the absence of proper primers. These devices consist, substantially, in forming upon the exterior of the vent a recess or receptacle for containing fulminating primer, and employing therewith a sett or plug, which the inventor calls a vent stopper, which closes it, and is confined thereto by some efficient means; and a fulminating primer provided with a casing of thin copper, or other suitable material, which, by its expansion against the sides of the recess or vent, closes the joint to the escape of gas. The primer is ignited by a blow applied to the exterior of the sett by a lock or otherwise. *Patent completed.*

3235. D. GRAHAM. *Improvements in steering and manœuvring ships or vessels, and in the apparatus employed therein.* Dated December 2, 1862.

In carrying out this invention, under one modification or system of arrangement, an opening is formed in the stem or "dead wood" at the forward part of the vessel, and in this opening is fitted a retangular or other suitably shaped rudder; or instead of being fitted in an opening in the ordinary stem, the rudder may be set to project forward beyond this stem. This rudder or steering apparatus is fitted on a vertical shaft which passes down through the central part of the rudder, and is stepped in a footstep bearing arranged for the purpose in the framing of the opening, and which extends in a line with the lower part of the keel. The rudder may, however, be fitted up and actuated in various other ways. The shaft is carried up on deck, from which point it is suitably connected to a steering wheel by means of bevel or other equivalent gearing. The former rudder made to be made supplementary to the usual one at the stern, or the vessel may be wholly steered by it. *Patent abandoned.*

3236. A. P. CHARLES. *Improvements in candles and night lights, and in the lamps or apparatus for burning the same.* Dated December 2, 1862.

This invention relates—1, to that class of candles and night lights in which a large illuminating power is not required so much as a continuous light of feeble power for a small expenditure of fatty matter. This part of the invention consists in making candles and night lights of considerable thickness and length, and with thin wicks, so that they may burn for a greater number of hours, and when extinguished, after burning as long as may be required for the time, may be readily lighted again, and so on until the whole of the candle or night light is consumed. The patentee makes night lights and bedroom candles with very thin wicks, surrounded by a very considerable body of tallow or fatty matter, and of such a length that they will last from 30 to 40 or more hours. Such candles or night lights will not, however, burn like ordinary candles, and they require the assistance of some contrivance or apparatus to prevent the melted tallow or fatty matter from spilling or guttering, and thereby wasting the candle. This apparatus in its various forms constitutes the second part of the invention, and consists of a small cup of any suitable shape adapted to a tube which forms a nozzle or cap, and is placed on the candle. This nozzle by its own weight descends on the candle as the tallow burns away, the cup acting as a reservoir to hold the melted fatty substance. *Patent completed.*

3237. R. K. CAUTLEY. *Improvements in electro-thermal baths.* (A communication.) Dated December 2, 1862.

This invention consists in the novel construction and arrangement of the parts of an electric bath, whereby the current of electricity is more perfectly controlled and more

conveniently and advantageously applied to the human body for the cure of disease. *Patent abandoned.*

3238. H. J. SIMLICK. *Improvements in the manufacture of cigar and pipe lights.* Dated December 2, 1862.

In carrying out this invention, the inventor proposes, instead of forming the holders of these lights of glass, wood, clay, or wood and straight wire combined, to form such holders of spirally-twisted wire, or strips of metal, the coils of which are to be slightly opened or separated, in order to allow of the circulation of air between the coils. *Patent abandoned.*

3239. B. BROWNE. *Improvements in the construction of knobs or handles of door locks, and in the mode of constructing same with the sliding bolts thereof for advancing and drawing locks and bolts.* Dated December 2, 1863.

In carrying out this invention, the inventor employs a knob working on a fixed axis, and fixes therein a short crank or arm, formed with a small pin which fits in a vertical groove made in the bolt, so that, by turning the knob in a semicircle in the said goove, the bolt will be moved by the said pin in a straight line either backwards or forwards, either for drawing back or pushing forward the bolt, and will retain the same firmly in either position, thereby dispensing with the use of a spring for pushing the bolt out, as heretofore practised, and by these means keeping the bolt within the lock when the door is opened, instead of the bolt projecting beyond the edge of the door, as is now the case, and which in practice is found very objectionable. He employs a spring to press on the edge of the crank or arm aforesaid for keeping the same steady. *Patent abandoned.*

3240. H. WYLDE. *Improvements in electro-magnetic telegraphs, and in apparatus connected therewith.* Dated December 3, 1862.

This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated February 18, 1863.

448. G. T. Bousfield, Loughborough Park, Brixton. Improvements in the manufacture of boots and shoes, and in preparing india rubber for such and other uses. (A communication.)

Dated March 5, 1863.

626. T. W. Osborne, Aston New Town, Warwick, lamp maker. Certain improvements in lamps.

Dated March 11, 1863.

659. H. Fletcher, Manchester, engraver and mechanician. Improvements in cleaning and preparing cotton for spinning.

Dated April 22, 1863.

1002. H. B. Barlow, Manchester. Improvements in shoes, boots, and other coverings for the feet. (A communication.)

Dated May 14, 1863.

1216. L. S. Chichester, Brooklyn, New York. Improvements in machinery for weighing grain.

Dated May 25, 1863.

1315. J. Hilliar, Cheapside, manufacturer. Improvements in the construction of the frames, sashes, shutters, blinds, and ventilators for windows or other openings, parts of which improvements are also applicable to other constructive purposes.

Dated May 26, 1863.

1326. F. W. and J. Kitson, Leeds. Improvements in the manufacture of the tyres for railway wheels, and in the means of securing the tyres to the wheels.

Dated June 4, 1863.

1396. H. Pollack, Hamburg. An improvement in the manufactute of scarlet, brown, and orange colours.

Dated June 5, 1863.

1404. J. Seaman, Worcester. Improvements in implements to be used in the cultivation of the soil.

Dated June 8, 1863.

1408. R. Wallis, Basingstoke, corn and coal merchant. Improvements in apparatus for loading and unloading vessels, and for elevating and otherwise conveying sacks, casks, and other packages, parcels, or objects from one locality to another.

1414. W. Miller, 70, Upper Stamford-street, Blackfriars. An improved mode of constructing ships, vessels, or boats, and of apportioning their freight to that construction, so as to prevent their sinking or being destroyed by fire.

Dated June 11, 1863.

1448. M. Hatschek, 32, Lower Belgrave-place, distiller. An improved method of mashing.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated June 19, 1863.

1536. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. Improvements in machinery for the manufacture of bolts and rivets. (A communication.)

LIST OF SEALED PATENTS.

Sealed June 26, 1863.

3474. F. B. Anderson.
3475. W. and H. Bowser.
3485. J. W. P. Field.
1. R. H. Collyer.
4. M. E. Bowra and A. E. Francis
7. J. J. Southgate.
9. W. Soutter.
16. A. Bamford, R. Blomley, R. Taylor, and J. Lett.
173. W. Clark.
347. C. Parigot and A. Grivel.

Sealed June 30, 1863.

12. W. A. Distin.
19. H. J. Sergeant.
21. R. C. Ransome.
22. A. S. Bolton.
25. W. Philippi.
62. G. Dowler.
88. M. Vogl.
90. F. Fenton.
97. W. Clark.
126. W. Johnson.
27. W. Astrop.
31. E. B. Keeling.
34. J. Howard and J. Bullough.
42. C. T. Judkins.
43. J. Eckersley.
44. J. Leigh.
47. M. Hodgart.
50. G. Turner.
51. J. Whitworth and W. W. Hulse.
59. G. C. Grimes.
142. D. F. Leblanc.
156. W. E. Newton.
171. H. A. Bonneville.
183. J. Holt.
193. H. Holcroft.
535. H. Edmonds.
558. W. Gray.
875. J. Macintyre.
914. H. Caudwell.
1025. W. A. Shaw.
1140. P. Bourne.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, June 30, 1863.

415. J. W. Crossley. Press papers.

422. J. H. Haywood and W. Vernon. Packing bonnet fronts.

431. E. Deville. Life-preserving coats or garments. (A communication.)

442. J. F. Spencer. Regulating and working the valves of steam and other engines.

443. J. H. Bly. Cooking stoves.

448. G. T. Bousfield. Boots and shoes.. (A communication.)

449. J. Puntis and G. Cox. Displaying in the open air or indoors illuminated designs, devices, mottoes, or announcements

461. W. Marsden. Buttons and other similar fastenings.

463. J. Bentley and H. Booth. Looms.

466. R. Bell. Armour plating, or protecting ships and vessels.

474. F. J. Manceaux. Firearms.

477. A. H. Rémond. Preserving provisions.

488. R. A. Brooman. Dressing millstones. (A communication.)

493. T. and A. Dickins and H. Heywood. Ornamenting fabrics.

494. J. Tatham. Fibrous materials for spinning.

510. A. Jünger. Life-preserving garment.

520. J. Fitter. Construction of castors for tables.

525. J. Gailey. Supplying air for mixture with gases and other aeriform fluids.

531. N. Thompson. Sawing wood.

539. W. A. Wilson and J. Smith. Furnace fire-grates.

611. W. Clark. Manufacture of sulphuric acid. (A communication.)

627. J. Howe. Construction of the crossings of railways.

628. W. Clark. Firearms. (A communication.)

634. A. Cuthell. Self-acting dampers.

643. A. V. Newton. Elastic carriage wheels. (A communication.)

657. W. E. Newton. Laying of wooden floors. (A communication.)

767. W. Clark. Agricultural apparatus. (A communication.)

903. G. Low. Machinery for boring rocks and other hard substances.

1074. S. S. Marling. Scouring, washing, and cleansing woollen cloths and other fabrics.

1180. C. L. Van Tenac. A new wrought-iron railway sleeper. (A communication.)

1181. C. L. Van Tenac. Armour plates of hammered or rolled wrought iron.

1216. L. S. Chichester. Machinery for weighing grain.

1253. R. Bunting. Cutlery.

1310. P. Leprovost. Carriages and vehicles for railways and other roads.

1456. J. Webster. Indurating iron, and protecting iron and steel from oxidation.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1553. H. Cartwright.
1556. W. E. Newton.
1560. J. Macintosh.
1566. J. and W. H. Blakeley.
1580. G. C. Morgan.
1894. J. Lancelot.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1479. J. Saxby.
1810. W. E. Newton.
1623. A. W. Williamson.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending June 27, 1863.

No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.
3055	0	4	3127	0	4	3141	0	10	3155	1	8	3170	0	4	3185	0	4
3114	0	4	3128	0	4	3142	0	4	3156	0	4	3171	0	8	3186	0	4
3115	1	2	3129	0	4	3143	3	0	3157	0	4	3172	0	4	3187	0	4
3116	0	10	3130	0	4	3144	0	6	3158	0	4	3173	0	4	3188	0	10
3117	0	4	3131	0	4	3145	0	10	3159	0	4	3174	1	0	3189	0	8
3118	0	8	3132	1	6	3146	0	10	3160	0	10	3175	0	4	3190	0	8
3119	0	4	3133	0	8	3147	0	10	3161	0	4	3176	0	4	3191	0	4
3120	1	4	3134	0	4	3148	0	4	3162	0	4	3177	0	4	3192	1	10
3121	0	10	3135	0	4	3149	0	4	3164	0	8	3178	0	4	3193	1	0
3122	0	4	3136	0	10	3150	0	10	3165	1	0	3179	0	10	3194	0	8
3123	0	4	3137	0	8	3151	0	8	3167	0	8	3181	0	6	3195	1	0
3124	0	10	3138	1	2	3152	0	4	3168	0	10	3182	0	4	3196	0	8
3125	0	4	3139	0	10	3153	0	4	3169	0	4	3184	0	4	3197	0	8
3126	0	8	3140	0	8	3154	0	4									

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-bdgs, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	5	0	to	6	10	0	2½
Nail Rods	do	7	0	0		7	5	0	
Hoops	do	8	5	0		8	10	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		5	17	6	
Rails	do	5	12	6		6	0	0	net
Foundry Pigs, at Glasg, No 1	do	2	10	6		2	16	0	
Swedish Bars	do	11	10	0		12	0	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	96	0	0		0	0	0	3
Hammered Bottoms	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd.	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	6	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8¼		0	0	8¾	
Fine Foreign	per ton	94	0	0		96	0	0	
TIN:—									
English Block	per cwt.	6	2	0		0	0	0	2½
do Bar	do	6	3	0		0	0	0	
do Refined	do	6	8	0		0	0	0	
Banca	do	6	14	0		6	15	0	nett
Straits	do	6	7	0		6	10	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	8	6		1	9	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
LEAD:—									
Pig, English	per ton	20	10	0		22	15	0	2½
" Spanish Soft	do	19	17	6		19	10	0	
Shot, Patent	do	23	10	0		0	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	27	0	0		27	10	0	

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.		£	s.	£	s.
Teak ... load	£12	0	£13	0	Archangel, yellow...	£13	0	£13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
" yellow pine	3	10	4	10	Finlan	9	0	10	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	15	0
Quebec oak, white	5	10	6	10	Gothenburg, yellow	10	0	11	0
" birch	3	10	4	10	" white	9	0	9	10
" elm	2	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderhamn	9	10	10	10
" fir	2	10	3	10	Christiania, per C., 12ft by 3 by 9 in.				
Memel fir	3	5	3	10					
Riga	3	0	3	5	Christiania, yellow	21	0	23	0
Swedish	2	10	2	15	Deck Plank, Dantzic,				
Masts, Quebec red pine	5	0	6	0	per 40 ft. 3 in.	0	14	1	4
" yellow pine	5	0	6	0	PUMICE STONE pr ton	5	10	9	0
Lathwood, Dantzic, fm	5	10	6	10	OILS, &c.				
" St. Petersburg	8	0	8	10	Seal, pale ...per tun	47	10	48	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	78	0	81	0
					Cod	53	0	54	0
					Whale, Sth Sea, pale	46	0	0	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	59	0	59	10
St. John, white spruce	14	0	15	10	Cocoanut, Cochin	48	0	0	0
Yellow pine, per reduced C.					Palm, fine	36	0	0	0
					Linseed	44	15	45	0
Canada, 1st qual.	17	0	18	0	Rapeseed, Eng. pale	48	0	0	0
" 2nd do.	11	0	12	0	Cottonseed	33	10	41	0

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 10, 1863.

THE TRIAL OF STEAM FIRE-ENGINES.

IN our last number, we mentioned that the trials, commenced on Wednesday, were continued on Thursday. The engines having to draw water from a depth of 16 ft., and to force it into a hood fitted into the side of one of the water temples, through a considerable length of hose. The tank into which the hood delivered was calculated to contain 18,000 gallons, and the heights and distances were as follows:—From the surface of the water to the landing on which the engines stood, 16 ft.; from the level of landing to the rail which supported the jet pipes, 28 ft.; from the level of the water, from which the engines pumped, into the hood, 79 ft.; distance, in a direct line from the engines to the hood, 383 ft.

These particulars will show that the test was no common one, and was well calculated to try the abilities of the competing engines in the severest manner. We stated that Messrs. Shand and Mason, and Messrs. Merryweather, accomplished their allotted task in a way which left little to be desired; proving conclusively that, even under the most trying circumstances to which steam machinery of the kind can be exposed, it is capable of doing good service. Messrs. Easton and Amos' engines, from some cause, failed to draw water; indeed, the mere fact of propelling the water through a long stretch of hose was by no means the principal difficulty. Fire-engines are designed for forcing, not drawing water, and a clear lift of nearly 19 ft. into the pump barrel was a test, such as they were neither intended for, or likely to be called on to repeat during the fulfilment of their missions. The American engine drew water almost at the first attempt; but, unfortunately broke down, with a smashed cylinder lid, before it had been many minutes at work. Short as the time was, the quantity of water lodged in the tank was sufficient to demonstrate the enormous powers of the machine.

The "Manhattan," in being brought to its place on the day previous to the commencement of the trials, was, unfortunately overturned in the gardens, smashing its fore carriage almost to pieces, besides breaking one of the fly-wheels and cracking the other. The piston rod of this engine is fitted with a long cross-head, which carries two connecting rods, which return along the sides of the cylinder, and lay hold of pins set in two small fly-wheels, mounted on the shaft of a rotary pump. The nave of the destroyed wheel remained uninjured, and with it the crank pin at that side; but the opposite wheel was cracked through the centre boss, although the rim held together. The boiler not being injured, the front end of the engine was mounted on a four-wheel truck, in lieu of the proper fore carriage, and without taking any part in the competition for the prizes, the "Manhattan" got up steam on Thursday, and displayed powers sufficient to convince many that, if in good order, English builders would have found it anything but a despicable rival. A few minutes' work, however, caused the crack in the fly-wheel to spread so much, that the fire had to be drawn to avoid further mischief.

On Friday, the small engines were submitted to almost precisely the same test as that which their larger brethren had already undergone the day before; the same height of lift, the same length of hose to force through, the same hood and tank to pump into; the sole difference being, that instead of filling the tank quite full, which would have occupied much time, each trial lasted one hour, at the termination of which the depth of water lodged in it afforded a means for comparing the relative merits of the competitors. The competing engines were—Mr. Roberts' "Princess of Wales," Mr. Merryweather's "Deluge," Mr. Lee's "Alexandra," and Messrs. Shand and Mason's small engine. Mr. Roberts' was the first to draw water, almost at the first attempt, going on steadily, without stop or interruption, until his task was accomplished. The rate of the engine was very even; the steam easily maintained at 80 lb. to 100 lb., without any excessive firing; the water level very steady; and the supply of steam abundant and free from priming. The jet thrown was very good, being close, compact, and without air spurts. Owing to a defective rivet giving way, in a stay which steadied the crank shaft bearing, a certain amount of caution was necessary, as the slightest approach to over-driving would have inevitably led to a break-down; but notwithstanding this mischance—if the incident deserve the term—the engine continued and ended its undertaking after a very excellent fashion.

Mr. Roberts' trial concluded, Messrs. Merryweather got their small engine to work, after some difficulty, the presence of air in their suction pipes being rendered apparent every now and then by a crackling spurt in their jet. The performance of this little machine was, nevertheless, on the whole, satisfactory; and although some little trouble was experienced in keeping up the steam at first, yet there never was a sufficient reduction of pressure to render a stoppage imperative. After all, the question of keeping steam rests so completely on the skill of the stoker, that it is really a very imperfect test of the powers of an engine. Most of the stokers, too, employed on the occasion, were comparatively new to their work; and we can assure our readers that firing an engine of the class exhibited, is a very different affair from anything else which generally falls within the province of those who have to deal with furnaces. Thus, engines which on the first day of trial could scarcely keep their steam up to 60 lb., found no difficulty on subsequent occasions in doubling that pressure, with a corresponding increase in the amount of work done.

Mr. Lee following Messrs. Merryweather, got to work after some delay, and continued steadily to the end; the steam pressure easily maintained at 80 lb. to 100 lb., without excessive firing.

Although Shand and Mason had already performed all that was required for the purpose of competition with their large engine, they got up its steam on Friday, and tried again at the 16 ft. lift. After two or three attempts they got water, and threw one very beautiful perpendicular jet close to the engine. Stopping for a few seconds, some difficulty was experienced in getting to work again, which indeed was not accomplished until two jets were substituted for one, in order to permit such a reduction of pressure in the air vessel, as enabled the engine to start freely at a high speed. The nozzles employed were one of 1 in., the other 1⅛ in., diameter; the jets thrown solid, steady, and very even in height. Their elevation could not have been much less than 120 ft.

Messrs. Easton and Amos' engine, the "Sabrina," standing on the bank of the lower pool, and drawing its water from thence, threw two splendid jets for an hour at a time. Horizontally or vertically directed, the distances reached were immense; and the jets, although occasionally fitful and scattered, were for the most part compact and of good quality.

Messrs. Shand and Mason, after a little time, withdrew their large engine, which had been playing much more for pleasure than business for more than an hour, in order to make room for their smaller engine. At the commencement of the competition on Friday morning, this machine had been one of the first, if not the first, to draw water; but a mysterious handful of shavings in the suction-pipe, rendered it inoperative for a time, compelling the removal of the foot-valve in order that it might be properly cleaned. This circumstance had, of course, occasioned a considerable delay, which the proprietors were anxious to make up for. But for a time the engine started, and re-started in vain. No water could be drawn. Another examination of the suction hose revealed the cause. The india-rubber tubing, instead of having the brass wire distending-rings inside of all, had yet another coat of india rubber within these. This inside lining had, under the pressure of the atmosphere, collapsed, being torn away from the wire. Thus the tube, perfect outside, was really completely stopped within, and as there was no other hose on the ground, with unions which would suit the pump, Messrs. Shand and Mason had to send to London for fresh couplings, so that the engine did not really get to work until nearly 7 o'clock in the evening. It then played into the large tank for an hour without intermission, throwing a beautiful jet. Steam was kept at 140 lb. to 180 lb. without the slightest difficulty; the engine making 120 to 130 revolutions per minute, the fire-door, indeed, being open a considerable portion of the time. Such a repetition of misadventures were sufficiently vexatious, as, no matter what the real state of the case may be, the general public are apt to draw erroneous impressions. Most of the visitors, too, had gone, leaving however a small number of those, whose good opinion was best worth having, behind.

We have yet to describe the most exciting contest which took place at any time during the three days (ever to be remembered in the annals of steam fire-engines) which the competition lasted.

At about 5 o'clock Messrs. Merryweather's large engine "Sutherland," Mr. Lee's "Victoria," Messrs. Shand and Mason's large engine, and Mr. Roberts' "Princess of Wales," the same we have already partially described, proceeded to the north water-tower, in order to test their powers of throwing vertical jets. Suitably placed on the gravel walk, in front, their suction hose pipes were lowered through holes broken in the boundary wall, into the large pond outside. The delivery hose was led round to the back of the tower, where a rough frame and scaffold had been provided. To a suitable cross-rail on this, 10 ft. perhaps, above the level of the engines, the jet-pipes were firmly lashed, in a vertical position, close (we thought too close) together. By this arrangement it will be understood that the jets rose perpendicularly, and parallel to the tower, whose ten floors afforded an admirable scale of comparison for the competitors.

Messrs. Shand and Mason, first ready, commenced with a jet 1⅜ in. in diameter, attaining at their first trial an altitude of about 100 ft., with a very low pressure of steam. Stopping, from some mistake, for a couple of minutes, they, on recommencing, easily threw a jet of about 170 ft., but finding themselves overtopped by Messrs. Merryweather, who had

also got to work by this time, they raised steam to 120 lb., and, with this pressure, succeeded in throwing a magnificent solid jet to a height of over 180 ft., quite overtopping Merryweather's jet for the time, but the boiler proved too small to maintain the supply of steam necessary for such an extraordinary exertion, and after a struggle, exciting and well-contested in the extreme, they gave way to Messrs. Merryweather, who attained a height of 180 ft. with a nozzle of 1½ in. in diameter, keeping up this tremendous stream with a force and power which rendered it magnificent. In fact, it seemed as if the "Sutherland" had never properly got to work before. The jet was solid, and without air. The engine maintained its speed with great regularity, the steam pressure varying very little from 100 lb., without excessive firing, and that in the air vessel fluctuating at each stroke of the pump some 8 lb. or 10 lb., or from 80 lb. to 90 lb. It was evident that the engine could keep on all night, just as well as for the time the trial lasted.

Mr. Lee's "Victoria," to our surprise, did almost nothing. Getting to work soon after Shand and Mason, a considerable space of time elapsed before any water appeared at his jet-pipe, and when it did come, the volume, although of good diameter, scarcely exceeded a height of 50 ft. We understand since that the piston, which is of steel and very thin, was seriously injured by the accident on the previous day, which quite accounts for such a result.

Mr. Roberts, who had kept his fire banked up since the trials in the forenoon, was one of the first to start; but his engine had not made two revolutions, when the upper feed-pump valve became gagged by a small fragment of iron. Removing the caps and cleaning the pump occupied some time, the others being ready to cease operations by the time the "Princess of Wales" began. Nevertheless, she did not forfeit one tittle of the good opinion already earned, throwing a ⅞-in. jet from 120 ft. to 150 ft. high. Had the experiment continued, we feel little doubt that still better results would have been obtained, but the lateness of the hour brought all further trials to a close. The comparative weights considered, however, we will find that the performance of this little engine was as good, *cæteris paribus*, as that of either of its heavier adversaries.

In our last week's number, we gave our readers a somewhat hasty and imperfect description of the various engines exhibited. We are now enabled to supply some further information, which we look on as extremely interesting. Steam fire-engines are a novelty in engineering; and the trial of last week is, to a certain extent, fully as remarkable as the memorable one at Rainhill, which first brought the locomotive into public favour. It has not only been a trial of what different engines could accomplish, but of what steam power, under the most abnormal circumstances, could achieve; and it is scarcely possible to conceive an experiment, which could more fully illustrate that wonderful flexibility of application—if we may use the phrase—which renders the steam-engine useful under every possible circumstance or situation. As the representatives, too, of a description of machinery almost unique in this country, everything regarding these engines is of interest and importance to the engineer. Whether their manufacture will ever become as extensive in this country as it has in America, is a question which interferes very little with the value of the lesson conveyed. Day by day we find an increased tendency on the part of engineers to reduce the weight of their machinery, and here we find engines capable of giving nearly an effective horse power for every cwt. of dead weight. The lesson to be drawn, scarcely requires comment at our hands, and we feel little doubt that the past trial will bring forth good fruit in due season.

The following are some of the principal dimensions and particulars of Shand and Mason's small engine:—The upper part of the boiler is cylindrical, of Bowling "best best" iron, one-fourth of an inch thick, welded, 2 ft. 1 in. in diameter outside, and about 2 ft. 6 in. high. The upper part, turned to a round flange, is bolted to a suitable plate, through which the up-take, 8 in. in diameter, passes. The lower part has a Bowling 2½ in. angle iron ring riveted round it. The fire-box shell is conical, 2 ft. 1 in. in diameter at the small end, which is fitted with a precisely similar angle iron ring, and 2 ft. 10 in. in diameter at the larger, outside, giving a diameter of circular grate of 2 ft. 7½ in. Both rings are accurately turned and faced in a lathe, so as to make a perfectly steam-tight joint, by the aid of a little red lead, when bolted together. The inside fire-box is of iron, of the same thickness, the top, which forms the tube plate excepted; this last being also of iron, but ½ in. thick. The vertical tubes are 195 in number, 1 in. in diameter outside, 12 in. long, and No. 19 wire-gauge thick, fitted without ferrules, by simple drifting. They are spaced only one-fourth of an inch asunder, and deliver the products of combustion into a smoke-box, about 5 in. deep, quite covered with water. From the centre of this smoke-box rises the up-take, surmounted by a handsome brass-stopped stack, 2 ft. 9 in. high. The distance from the grate bars to the tube plate is 2 ft., the height of the boiler over all about 4 ft. 6 in., the bottom clearing the ground about 15 in. By unscrewing the bolts which connect the angle irons, and those which unite the upper flange with the top plate, the entire cylindrical shell can be removed, permitting access to every portion of the interior of the boiler, tubes, smoke-box, &c., an advantage of the last importance. A space of some four inches, however, unavoidably remains between the boiler shell and the outer tubes, because the shell could not be drawn over the smoke-box, if its diameter were narrowed in order to approach the tubes. An unnecessary body of water would, of course, remain here, but for the following ingenious expedient:—A species of copper "pocket"—we cannot think of a better name—descends nearly to the crown of the furnace, all round between the shell and the outer tubes, displacing the water and supplying so much additional steam space, for the upper edges of this pocket are considerably above the water line. The boiler, in fact, carries steam below the water. Of course, no pressure except that due to the gravity of the liquid is exerted on the sides of the pocket which are traversed by the pipes leading to the gauges. The contrivance is extremely simple and answers its purpose admirably. A copper ring, drilled with a multitude of holes, surrounds the up-take, and supplies the steam to the cylinder through a copper tube 1¼ in. diameter, fitted with expansion joints. The exhaust steam pipe is 2½ in. diameter, terminating in a variable exhaust, not easily described without drawings; suffice it to say, that the orifice can be enlarged or contracted, by means of a hand-screw, being equivalent in area to a circle 1¼ in. in diameter when full open, and to one of ¾ in. when shut.

The pump is fitted with six india-rubber disc valves in the bucket, and, seven in the foot valve plate. This last can be removed in a few minutes, when by turning a nut the bucket can be withdrawn for examination or repair.

The fire-box is provided with two fire-doors—one behind, and the other at an angle of 45 deg. just in front of the hind wheel. A person standing on the foot plate behind, can fire the boiler when proceeding through the streets; the 24 ft. of suction which the machine carries ready screwed on, being coiled round the engine out of the way. On reaching the fire this door is shut, and the front wheels locked round. The other door, then become easily accessible; a small coal bunker being hung from the front axle, in a convenient position for the stoker. The weight of this engine as entered for the trial was 1 ton 9½ cwt.

We manage our commercial transactions now-a-days in a way little dreamt of fifty years ago. This machine has been sold, through the medium of the telegraph, for the use of one of the imperial palaces at St. Petersburg.

The boiler of the large engine, by the same firm, is almost precisely the same, in every respect but size, as that we have just described, the number of tubes being 328, 1 in. in diameter outside, and 14 in. long, divided into four groups, in order to permit freer circulation. The top plate of the smoke-box is strengthened by 8 tubular stays, 1¼ in. in diameter inside, which suspend it from the top of the boiler, being screwed into the smoke-box plate, and stopped by suitable screwed caps at the other end, outside the shell. These stays act as additional heating surface, although there is no current through them. There are no very remarkable features presented by the engines or pumps, the dimensions of which we have already given.

The valve-gearing of Messrs. Merryweather's "Sutherland" is very remarkable, if not unique. "On the middle of each piston-rod is keyed a boss carrying a short arm projecting horizontally. Parallel to and at a short distance from each piston-rod, are fixed in suitable bearings, so as to be able to revolve freely on their axes, two twisted bars or quick screws, having a pitch of 1 turn in 16 inches. At the ends of these twisted bars or screws, next the steam cylinders, are cut two strong square-threaded screws, having 1 turn in 1¼ inches, on to which are fitted two gun-metal nuts, which nuts are received by the forked ends of the weigh-shaft levers for moving the slide-valves. To the short arms on the piston-rods above mentioned, are attached two gun-metal sliding pieces, which clasp, and move freely on the twisted bars or screws, and having the same motion as the piston-rods, impart a slow, easy, reciprocating rotating motion to the twisted bars or screws, causing the gun-metal nuts and weigh-shaft levers to be brought backward and forward with a slow, easy action, thus moving the slide-valves into the required position—viz., that of closing steam and exhaust ports shortly before the end of the stroke, thus preventing the possibility of striking the ends of the cylinders—it will be clearly seen that, by this arrangement, each cylinder cuts off its own steam and exhaust, and is entirely independent of the other for forming the cushion required to stop the momentum of the pistons; thus, *each piston brings itself to rest;* but when at half-stroke, by means of a connection between the weigh-shaft levers, gives steam to No. 2 cylinder, the piston of which brings itself to rest, and liberates No. 1 piston, and so on alternately.

"The slide-valves are of the equilibrium piston form, and with full steam (150lb. per square inch) can readily be moved by the hand with a force of 5lb., thus saving power which is more usefully employed in forcing water."

The following are the awards made by the Committee:—

LARGE CLASS.

Messrs. Merryweather and Son, first prize ... £250
Messrs. Shand and Mason, second ditto. 100
Mr. Roberts, honourably mentioned.

SMALL CLASS.

Messrs. Shand and Mason, first prize ... £250
Messrs. W. Lee and Co., second ditto. 100
(Signed) EYRE M. SHAW, Hon. Sec.
July 8th, 1863.

In another portion of our present number will be found so much of the official report as bears on the relative performances of the different engines. The complete report is too long, able, and exhaustive for insertion this week. The different items are sufficiently suggestive; and if the results of the competition do not prove satisfactory to all parties, we trust they may lead to another trial, from which, we feel certain, equally valuable conclusions can easily be derived.

TITANIFEROUS IRON ORE.

THE reduction of the titaniferous iron ores—found in the form of sand on the shores of the Black Sea, the Bay of Naples, and also along the shores of New Plymouth, in New Zealand—has lately engaged the attention of practical metallurgists to a considerable extent. Several companies have been formed in the City with a view of working these deposits with profit; and considerable sums of money have been spent in experiments conducted with a view of arriving at some means of converting this rich and valuable ore on a large scale.

We have examined different specimens of this peculiar metallic sand; from the shores of New Zealand; from Poti, in Asia Minor; and from Naples. They have all a similar appearance, that of fine steel filings, and they are strongly attracted by a magnet. The Italian specimen is somewhat mingled with common sea-sand or silica. The great value of these ores is due to their large percentage of iron, to their freedom from sulphur, phosphorus, &c., and to the presence of titanium itself in the form of an oxide. There is little doubt that steel is considerably improved by a mixture with titanium; and it is not improbable that the presence of this metal would also raise the quality of cast iron. The wonderful temper and tenacity of the sword blades of the Japanese are said to be partly due to the presence of titanium in the steel of which they are manufactured. It is stated by recent travellers in Japan that all the iron of that country is made from this peculiar sand. The sword-blades used by the Circassians are also made from the titaniferous iron ores of the country, and according to well-authenticated accounts their temper and durability is something marvellous. Of course, the mere presence of titanium does not wholly account for excellent quality of the iron manufactured by these semi-barbarous nations; the ore itself is pure, and it is always smelted with charcoal.

The most common mineral containing titanium is this titaniferous peroxide of iron. It is very similar in appearance to the magnetic oxide of iron, and it is, indeed, often mistaken for the latter mineral. Titaniferous iron ore is found in small quantities in Cornwall. Its scarcity has prevented its adoption up to the present in practical metallurgy; and this is also the reason that the metal titanium has been only discovered within a recent period. The titaniferous oxide of iron of the secondary formations has always the appearance of black-grained sand, the particles of which are attracted by the magnet. For a long time the titanium was only known in the form of an oxide. It has been found united with nitrogen and carbon in the slag from the blast furnaces of the Merthyr Tydvil iron works, in the form of well-defined prismatic crystals, of a copper colour. The various titaniferous iron ores contain from 13 to 52 per cent. of oxide of titanium in union with oxide of iron. Metallic titanium is somewhat similar in appearance to brass. Up to the present the principal application of titanium has been in the form of titanic acid for painting porcelain. It is used to produce a pale yellow colour.

It will be at once seen that the great obstacle to the reduction of these peculiar ores on a large scale consists in their being generally found in a state of minute subdivision. It would be impossible to feed a blast furnace with such a material. Although a large amount of capital has been spent in experiments, we believe that, up to the time we write, no ready means have been found to make the sand cohere in masses large enough for the free passage of the blast. The experiments have been conducted by several eminent metallurgists, but the investigations have been necessarily secret. It is not improbable that bricks of the necessary tenacity might be formed of this material by the use of a "high-pressure" brick-making machine. A process of baking with an appropriate flux might also arrive at a similar result. Mr. Mushet has made some first-class steel from this ore; but the process was carried out in crucibles with their attendant expense. The steel was shown in the Sheffield Court, and in the New Zealand Court, of the late Exhibition.

Should the hopes prove well-founded that an admixture of this ore with our English makes of iron would improve the quality of the product, this fine sand could be injected through the tuyeres into the furnace by means of the blast. This process has been already carried out with powdered charcoal, and also with pulverized calcined iron ore. It is evident that the attainment of a profitable means of reducing this rich and pure ore is merely a question of time and well-directed capital. It may buoy up the hopes of those who have spent large sums in, as yet, unfruitful experiments, to remember that the ordinary processes of manufacturing—flowing on with the ease due to long practice and experience—have themselves been evolved from a costly process of trial and error.

ANALYSIS OF BOILER FEED-WATER.

THERE is no necessity to inform a user of steam power, that the deposits and their resulting hard incrustations in steam boilers are continual sources of loss and annoyance. Not merely does the presence of scale interfere with the conducting powers of the boiler plate, preventing the free circulation of the water, and thus causing much heat to flow uselessly up the chimney stack; but a progressive deterioration of the boiler itself is induced by the presence of these deposits. The plates get burnt, and lose their strength through being thermally insulated from the water, while some deposits exert a chemical influence towards thinning the plates from the inside. At one time the presence of boiler scale was believed to be a direct cause of explosions; the disruption and splitting of this formation, with the resulting sudden influx of water on the overheated plates, was believed to be sufficient to cause an explosion. Although this theory is now rejected, the incontrovertible deterioration of steam boilers through the presence of scale, is sufficient evidence to warrant the assumption that boiler incrustations take the lead in a train of causes annually involving much destruction of human life. All these effects are, however, gradual, and their daily passage may be unnoticed by an untutored eye; but the expense of cleaning a boiler, and the consequent stoppage of operations, are sufficient reasons to make the most ignorant user of steam power think seriously towards providing a remedy for this continual drain on his pocket. The ordinary way of cleaning a boiler, by chipping off the hard scale by means of chipping hammers, is of itself a remedy that—while staving off the disease—at the same time debilitates the patient. When incautiously done, the operation injures the plate, by thinning it and by jarring the whole structure. In searching for a sound remedy, he encounters a rather great *embarras de richesses*. Mechanical, chemical, and chemico-mechanical remedies, are offered him on all sides. The chemical composition of water is very varied, and it is evident that an efficient remedy at one place may often loose its efficacy a few miles further on. The best way to meet an enemy you may have to encounter for years, is to get as much knowledge of him as possible; in this case, the penalty of ignorance is perhaps loss of life, while it is most certainly loss of property. A want of due knowledge of the causes that lead to the formation of boiler scale is evidently the reason that many good remedies have been wrongly applied.

It is thus apparent that in many cases, the wisest, and in the end, the most economical plan, is to submit the feed-water to the analysis of a competent chemist. This is often very inconvenient, and sometimes even impossible. There are, however, means by which an intelligent workman can ascertain, with tolerable accuracy, the chemical composition of the feed-water of his boiler; the knowledge of which can direct him to the choice of the proper means to meet his special case.

Most spring and river waters contain, in solution, varying proportions of lime, soda, magnesia, and other minerals. The most generally met substances, however, are sulphate of lime (plaster of Paris or gypsum), and carbonate of lime (common chalk); and these also form the most dangerous incrustations. The latter mineral is the one most commonly found in spring water in combination with carbonic acid gas. The presence of this acid enables the water to hold the chalk in solution; on its being driven off by the application of heat to the water, the chalk is precipitated to the bottom. Several plans for purifying feed-water are formed on this principle; one of these inventions was exhibited in the French Department in the Western Annexe of the late Exhibition.

The power of water to hold sulphate of lime is also diminished when its temperature is raised. Thus, 100 parts of water, at 77 deg. Fahrenheit, can dissolve 0·254 per cent. of sulphate of lime, but at boiling point the same amount of water can only hold 0·217 per cent. of this substance.

Dr. Van den Corput, in a paper on boiler incrustations, in the *Bulletin du Musée de l'Industrie*, of Brussels, gives the following practical chemical method for ascertaining with more precision the amount of the "hardness" of water, as it is popularly called; a state generally caused by the presence of the above ingredients. Water, containing carbonate or sulphate of lime, has the property of more or less precipitating solutions of soap. This will be noticed by most persons who use hard water for their daily ablutions. Sebasic alkaline salts are changed into sulphates or carbonates, and into an unsoluble chalky substance. The latter opalizes in the dull liquid, or, assuming a granular consistency, it swims on the surface of the water. These appearances give a means of ascertaining the amount of hardness of the liquid; and it can thus be determined from the dulness of its appearance,

and the amount of the chalky matter precipitated.

The process simply consists in pouring, drop by drop, an alcoholic* solution of soap into a determinate quantity of water, by means of a graduated glass. This must be continued until the chalk or the salts of magnesia generally present are completely separated, when a frothy appearance will be noticed on the surface of the liquid. This appearance determines the moment when the operation is finished, and the chalk is completely separated. The *proportionate* amount of the solution used to produce this effect—which is read off the scale of the graduated glass—determines the relative amount of chalk contained in the water.

We mentioned above that water when heated was able to hold less sulphate of lime in solution than when cold. This phenomenon affords us a means of ascertaining with some degree of certainty whether the feed-water is impregnated with more carbonate of lime than sulphate of lime, and *vice versâ*. The alcoholic solution of soap we have referred to above is mixed drop by drop with two separate and equal volumes of water. One of these mixtures must undergo the process of boiling and filtering. The quantity of the soapy solution required to cause a foaming appearance on the top of the water, when shaken up, it will be much less than that required for the other portion which has not undergone the boiling and filtering processes. This assay will answer even if the water contains lime in the form of chloride of calcium. This latter salt does not form a hard incrustation, and its presence is not so dangerous as that of sulphate of lime. The latter substance generally falls in the form of amorphous gypsum; but sometimes in small crystals of hydrated gypsum, forming the worst description of scale. Under long exposure to a high temperature, it becomes changed to anhydrite, having the crystallized form and the hardness of the natural mineral.

MACHINE FILE-CUTTING.

THERE are certain processes in the industrial arts which have hitherto set every attempt at the introduction of machinery for their performance at defiance. First amongst these we must rank file-cutting, which is still, as it has been for centuries, almost wholly conducted by hand labour, although the advantages to be derived by the substitution of steam machinery instead are so obvious and important, that the greatest exertions have been made from time to time to introduce such combinations of mechanism as would turn out files of good quality fast enough to reduce their present high price. It would be idle to go into the history of such machines; suffice it to say, that they have one and all failed in some little particular, and that hand labour still reigns supreme in this department of trade.

In spite, however, of all that machine tools have done for us, the consumption of files appears rather to increase than fall off; nor is this much to be wondered at. After all, the fitter's principal tool must be the file. Hand-saws are as useful as they were before the invention of the saw-mill. The navvy requires his pick, the excavating machine notwithstanding; and so will the good old file be needed, while there is an engine to fit up, a clock or a spinning mill to construct.

It is not without some interest, then, that we have read a report in one of the Birmingham papers *(The Post)*, which states that some very successful experiments have been undertaken and carried out there with Bernot's file-cutting machine, which is already in successful operation in many parts of France. As the subject is one of much importance, we do not hesitate to present our readers with the following abstract of this report:—

"Some few weeks ago we announced that a company had been formed for the purpose of making files by machinery, and that, owing to the refusal of the trades' unions of Sheffield—the seat of the file manufacture—to have machinery there, the first works of the new company were to be erected in Birmingham. We further stated that while the patents of Mr. Greenwood, of Leeds, were to be brought into requisition for the making of files in blank, that of M. Bernot, which has been in use some time both in France and Belgium, was to be used for the cutting, the most important and hitherto the most difficult branch of the manufacture. The value of M. Bernot's patent file-cutting machine, we remarked, consisted in this:—That while it would do the work of six or seven men, it only required a comparatively unskilled workman to manage it, whereas the hand file-cutter is a highly skilled workman, commanding a proportionately high rate of wages. It was also hinted that the files cut by this machine were superior in quality to those cut by hand; but this is a question which practical men would no doubt like to decide for themselves. They now have the opportunity. Since we last wrote on this subject, Mr. Allinson, who was engaged by the promoters of the company to report on the manufacture, has brought one of M. Bernot's machines—that shown at the Exhibition of 1862—down to Birmingham, and, by the permission of Messrs. W. May and Co., has put it up in their works, in Tennant-street. The machine, which is very compact, resembles a steam hammer in its general appearance, and the principal features which give it value may be shortly summed up as follows:—It is provided with a vertical slide carrying a chisel on the lower end. The top of this slide is pressed by a flat spring, which is governed by a cam mounted upon a shaft and actuated by a ratchet wheel and 'paul,' and thus the strength of the blow of the chisel is regulated to the varying breadth of the file. A projection at the other end of the slide comes in contact with a cam upon the driving shaft of the machine, and so sets the machine in motion. The blank to be cut is placed upon a travelling slide, which rests upon a semicircular bed, which is mounted in trunnions, resting in swivelling journals, so that the surface of the blank can be presented at the desired angle to the chisel. The blank is held parallel to the edge of the chisel by means of a weighted 'leveller.' All being ready, the file is fixed in the bed, the machine is set in motion, there is a terrible clatter for a moment or two, and the file runs out cut ready, after being hardened, for use. The rate at which the chisel goes may be judged from the fact, that it makes from 800 to 1,500 cuts per minute, and will produce about five or six times the amount of work which can be supplied by hand-cutting. It can cut files of every shape and description that can be cut by hand, and the work is produced with mathematical accuracy. The teeth raised are equidistant one from another, and of that uniform depth and sharpness that forms one of the chief constituents of a good file. This regularity gives evenness, and causes each tooth, when the file is brought into use, to do its proportionate share of the work, effecting thereby a more rapid reduction of the metal acted upon. The teeth, it is said, are not so liable to be broken out, as in hand-made files, where they project one beyond the other, and for which reasons the machine-cut files are found to be more durable. Rasps can also be cut by a suitable adaptation of the machine. This cutting machine has been in practical operation for several years at Douai, in France, and also in Belgium, where, we understand, the superior quality of the files has obtained preference in the arsenals, railways, and machinists' shops of both countries. They have also, we believe, been subjected in this country to severe trials, and have been found of excellent quality. 'The experience at Douai of the cost of working the machines is,' says Mr. Allinson, 'that two skilled mechanics will keep sixty cutting machines in thorough order, and that two persons properly acquainted with the work will make, repair, grind, and whet all the chisels required in working that number of machines. The cost of zinc for file beds is equal to about 3d. per machine per day—the cost of steel for chisels may be assumed, at the outside, at 6d. per machine per day. It is found at Douai that chisels for machine cutting last much longer than for hand, and will effectually cut more files without being re-ground. This arises from the fine edge of the chisel being rubbed a short distance along the surface of the blank to guide the hand cutter; whereas, in machine cutting, the chisel is drawn out of the cut without abrasion. The consumption of oil, and other small stores, are estimated to be the same per machine as in machinists' shops. The machines employed at Douai are of three sizes; but the experience they have now had, shows that the variety of sizes may be beneficially increased. To obtain the advantage of organization arising from a careful division of labour, file manufacturing should be on such a scale as would permit one description and size of work to be confined to one machine and one man, whose constant practice in this one operation would produce a file of a quality superior to anything under the present system of manufacture, and at the same time at a fraction of the cost.' From this it will be seen that Mr. Allinson contemplates carrying out the manufacture on the factory system.

"Mr. Allinson goes on to show the commercial advantages of the machine over manual labour:—'A machine (he says) to cut 14 in. hand bastard files makes 1,000 cuts per minute, or 600,000 cuts per day. A good file-cutter upon the same size and description makes 140 cuts per minute, or 84,000 per day. The machine works as rapidly and perfectly at the end as at the beginning of the day. The man's ability to sustain his rate along with good work is materially affected by fatigue and the relaxation of the muscles consequent on such heavy and continuous labour. At Douai, the machine cut twelve dozen of such files per day. A man cannot cut by hand more than two dozen per day and maintain this average rate for a week. The wages for the week's work of hand cutting would be 44s. The cost of labour and superintendence for the machines would be less than this, but assuming it to be the same, the following is the result of a comparison of the two:—By hand, 12 dozen of files are cut at a cost in labour of 44s. By machine, 72 dozen, or six times the quantity, at a similar cost in labour of 44s. The machine possesses advantages in producing fine cut files even more considerable than shown by the coarse cut just mentioned.' The basis upon which these calculations are made seem to be the actual results at Douai, and the price lists of the File Cutters' Union at Sheffield. In ascertaining the cost of making by hand, however, a discount, varying from 12½ to 20 per cent., is taken off the list price, as allowances are now made therefrom in exceptional cases to such makers of common files as are willing to employ inferior hands, and a liberal rate of wages is charged for working the machines. The actual results of the working of the machine now in Birmingham seem to be these—the youth of whom we have spoken receives 16s. per week, and can cut 12 dozen files per day, the machine, however, running at only 600 or 700 cuts per minute. A hand file-cutter could not cut these same twelve dozen files in less than a week, and would receive from 40s. to 45s. for doing it. The youth receiving 2s. 8d. per day, therefore, does the work for which the man would receive from 40s. to 45s. The whole cost of the machine for the day's work is 3s. 4d." We may observe that some of the files cut by this machine now lie before us, which we can safely pronounce as the best machine-cut files we have ever seen.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE July meeting of the above-named Society took place on the evening of Saturday, the 4th inst., at St. Swithin's-lane, City. Mr. Joseph Newton, President, occupied the chair. A very large attendance of members indicated the increasing interest which is felt in the proceedings

of the associated foremen. Several gentlemen were elected as ordinary or honorary associates, and among the latter was the Hon. Mr. Duncan, son of the Earl of Camperdown, and who is studying mechanical engineering under Maudslay, Field, and Sons. After the routine duties had been performed, the Chairman called upon Mr. Muir, of Woolwich Arsenal, and Vice-President to the Association, to read the promised Paper on "Forgings in Iron." That gentleman proceeded to comply, and after some preliminary observations said that the primary condition for obtaining a good forging, whether from under the tilt or the steam hammer, was, undoubtedly, the employment of good material.

In fagotting from slabs it should also be a rule to place invariably the thinnest slabs in the heart of the fagot, so as to ensure that the heat applied should permeate the whole mass equally. The proper construction of the furnace was another consideration of much moment, as was the employment of a skilful furnace-man. So great was the diversity of forging, both with regard to size and purpose, that it would be impossible to refer to each kind. It was only possible in a brief Paper to mention some of the most important, and they in this case would be those which seem of the most difficult character, and which required the greatest amount of care and caution in their production. Such forgings as were to have collars and projections were among the class named. In these it was of the highest importance to take down sufficient "stuff" to allow for finishing off, and to make sure that the projections were in their proper places. If the space between the collars were too little, the chances were that, in drawing out, the forging would become too small to turn up to the right size. If the space were too great, it involved the necessity of "upsetting" or staving up, and the grain of the iron was thus deranged and the forging would be consequently weakened.

It was a well-known fact that heavy shafts—for example, propeller shafts—which have to be coupled by means of large collars or flanges, are very difficult to forge soundly. Not unfrequently the collars were, after great care had been taken, found to be so hollow that a two-foot rule might be concealed in the central cavity. He (Mr. Muir) objected to having those collars rounded in forging, although he could find few who agreed with his views. It was far better, he believed, to forge the collars or flanges of such shafts as those he had referred to square, and to round them up afterwards. It was his impression that solidity would be found to result from this process in almost all cases; for if a proper heat were taken upon the work, it was next to impossible for a square forging to be made hollow. On the contrary, a circular forging could scarcely be made solid. The advantage arising from the mode of procedure he had indicated were, he thought, undeniable; the objection to it was its extra cost.

In one remarkable instance he had been permitted to forge a propeller shaft with a square flange. At four heats the four corners of the square were taken off, the flange was rounded up, and the work proved, as he had anticipated, a great success. He entertained, moreover, a very strong opinion that the great difficulty which had been experienced in obtaining a sound malleable iron gun might be overcome by first forging it in the square instead of the round form. There were many reasons for supposing—and, indeed, he might say that he knew—that many an important forging had been lost, or at least was sadly deteriorated, by the fagot having been composed of different kinds of iron; say, for example, hard and soft. In this case, there would be a natural resistance to amalgamation. Great care and practical judgement, therefore, were required in assorting the irons to be employed for particular forgings, and in putting them into classes in accordance with the special purpose to be served.

He would also recommend that, in any forging requiring taking down, well-rounded setts should be employed, so as to leave always a gusset or fillet, which would save the grain of the iron, and could easily be turned off afterwards if required. It was desirable, also, to put the last wrought heat into the furnace, after it has been worked either by planishing or swaging, and thus bringing it a low red-heat. This was a kind of annealing process which equalized the consistency of the surface. Besides, if one part of the latter had happened to get a larger share of hammering than another, the forging would, while undergoing this ordeal, manifest a tendency to bend, and this would be the fitting time to straighten it. Whatever the nature of the piece of work in hand, only so much of it should be made hot, or at least be brought to a welding heat, as can be at the same time operated upon. The parts submitted to unnecessary heatings will crystaltze, and, as a matter of course, become weak or brittle. In piecing or lengthening shafts, or large forgings of any kind, Mr. Muir recommended that when lays were used for the purpose, the scarfs of those lays should be left tolerably thick at the points. If they are thinned too much, the air acts upon them when drawn from the furnace, and they are sure to be too cold before reaching the anvil. The consequence will be disastrous if this contingency arise. You must then take another heat, without the certainty of being better off next time. It may become a sound union, but will it stand up to the required fire? As has been said, it is desirable in all cases to have the scarfs of the lays of a proper thickness to avoid these evils.

With regard to furnaces, Mr. Muir entered into some interesting particulars, for which we have not space, but he remarked that, when the work to be done was never likely to exceed a foot in thickness, he should suggest the following as proper proportions for the furnace:—3 ft. wide, and 22 in. high. At the doorway the fire-grate would thus be 3 ft. by 3 ft. The neck or flues should be 20 in. deep, and 14 in. wide. The chimney-stack should be at least 36 ft. in height, and the orifice 18 in. in diameter. The reader of the Paper was rather disposed to invert the rule with regard to the taper usually given to the inside of furnace chimneys; he would have them wider at the top than at the base. He prophesied that, if such a plan were adopted, there would be fewer complaints in reference to defective draught.

Mr. Muir proceeded to remark upon the desirability of employing workmen who had theoretically and practically a knowledge of the material with which they had to deal, and of paying them in proportion to their merits.

A discussion followed, which was of an eminently practical character. Mr. Onbridge complained that the vital question of the quality and kinds of fuel to be used in the preparation of forgings had not been touched upon.

Mr. Ives thought that further information might have been given as to the making up of forgings, the proper lay of the grain, so as to combine tightness with strength, &c.

Mr. Gray made some remarks of a similar tendency.

Mr. Stanley, in reference to a statement made by the reader of the Paper, as to the superior strength of beams which tapered from the centre instead of being parallel, thought that such beams should not have a straight, but a curved, or parabolically curved, taper, in order to give the maximum of strength.

Mr. Seccomb was much more ready to undertake a forging than to talk about it. He entered, however, into some practical details in reference to forgings, which demonstrated his capability for both talking and working.

Mr. Stabho spoke at some length, and though approving of what Mr. Muir had said, pointed out numerous items of interest in relation to the subject which had been left unnoticed.

The Chairman must admit that he, too, felt a little disappointed with the Paper. So far as it had gone, it was all very well, but it had not gone far enough. It was to be hoped that Mr. Muir would take an early opportunity of supplementing his work, and that other members of the Association, who were so well qualified to enlighten and instruct them, would assist in the task. A more appropriate subject it would be difficult to find for the consideration of that Society, and it ought to be treated of in all its varied points. He was not without hope that the question of "Forgings in Iron" would ere long be re-opened in that room. Mr. Newton further suggested that the claims of the Messrs. James to the founding of the railway system, as opposed to those of the Stephensons, formed a legitimate and proper field of inquiry for the Foremen Engineers, whose object was to elicit truth and maintain it. At their next meeting, Mr. Stanley and Mr. Humes would read Papers—the one on the "Slide Link Motion," and the other on the "Construction of Locks."

The meeting then separated.

MR. MALLET AND MR. GLADSTONE.

DURING the debate on the Exhibition building, in the House of Commons, Mr. Gladstone, in rather bitter accents, assailed Mr. Robert Mallet, who had been so conspicuously referred to by Mr. Gregory on a preceding evening as an authority on the stability of the building. Mr. Gladstone did not raise himself in the estimation of his hearers by sneering at Mr. Mallet's obscurity. Mr. Mallet bears an honoured name in the scientific world, not only as a writer on earthquakes but as an authority on gunnery and mechanical and civil engineering; and it reflected but little credit on Mr. Gladstone when he confessed that Mr. Mallet's name was new to him. Mr. Gladstone endeavoured to cast ridicule on Mr. Mallet by saying that he was author of the monster gun which was a monster failure. Mr. Bernal Osborne interjected a sentence to the effect that Lord Palmerston was the author of the monster gun. Later in the debate, Mr. Gregory stated that the monster gun was always known by the "Palmerston gun." Mr. Mallet has written a letter to the *Times*, in which he candidly says that Lord Palmerston in 1854 desired the War Department to have the 36-inch mortars constructed. In this he was sustained by the late Prince Albert; but for the merits or demerits of these mortars, in design and construction, Mr. Mallet says that he alone is responsible. He also says that if Mr. Gladstone or any one else will move for the production of the whole of the correspondence, it will be seen that the mortars have been "monumentalized" at Woolwich, through no fault of Lord Palmerston or of himself. We will not enter into the greater question of the capabilities of the Exhibition building any more than to say that we believe that the House of Commons acted in harmony with public opinion and common sense in rejecting the vote proposed by the Chancellor of the Exchequer for buying the building. Had the building been bought and decorated at the public expense, it would have been nothing more or less than a huge job.

BLUMBERG'S GLASS TILES.

MR. F. BLUMBERG, of Cannon-street West, has just patented an improved method of producing glass paving, tiles, or slabs, having therein or thereon suitable designs. The glass when in a molten state is run, in suitable quantities, into a pan mould, made of some material capable of bearing a high polish, and free from all irregularities; a plunger having a design upon it is caused to press upon the glass in the pan mould, and in its upper surface a counterpart of the design. When the slab is sufficiently cool it is removed to an annealing furnace, where it remains until fit to receive colour. The colour or colours may be applied in any manner, or the design may be painted on paper, or other material, placed on the indented design, and secured in position, filling up the cavity with plaster of Paris, or other suitable material. If the tiles are intended among other uses to be laid as paving for halls and other places, the pan mould is so indented that it shall leave small raised projections or points to roughen the face of the glass, and serve to give foothold.

ABSTRACT OF OFFICIAL REPORT ON THE TRIAL OF STEAM FIRE-ENGINES AT SYDENHAM, ON JULY 1, 2, & 3.

LARGE CLASS CONSISTING OF THE FOLLOWING ENGINES:—

	ton.	cwt.	qr.	lb.
MERRYWEATHER	2	18	0	8
EASTON and AMOS	2	18	3	12
SHAND and MASON	2	17	1	0
J. BUTT and Co.	2	14	0	4
NICHOLS (Manhattan)	2	10	1	4
ROBERTS	1	19	1	4
GRAY and Co.	1	18	1	4

FIRST TRIAL.

Delivering 1,000 *gallons into a tank at a true distance of* 67 *ft. and* 27 *deg. from the horizon. The water in the boiler being cold when the signal was given to commence, each Engine commencing to work on attaining a steam pressure of* 100 *lb. on the square inch.*

No.	Names.	Time of raising steam to 100 lb.	Time of filling tank.	Total.	Remarks.	No.	Name.	Time of raising steam to 100 lb.	Time of filling tank.	Total.	Remarks.
		min. sec.	min. sec.	min. sec.				min. sec.	min. sec.	min. sec.	
1	Easton and Amos...	13 14	6 16	19 30		3	Shand and Mason	10 51	12 19	23 10	Suction pipe choked, left off working about 2 minutes.
2	Merryweather	10 25	9 42	20 7	Began to work at 100 lb., fell directly to 40 lb., and continued so throughout, stopped, and steam rose to 130 lb.	4	Butt and Co...	16 30	6 48	23 18	
						5	Roberts	11 40	20 24	32 4	

SECOND TRIAL.

Delivering 1,000 *gallons into tank at same distance, commencing with full steam.*

No.	Name.	Steam at beginning.	Steam during work.	Time of filling tank.	Remarks.	No.	Name.	Steam at beginning.	Steam during work.	Time of filling tank.	Remarks.
		lb.		min. sec.				lb.		min. sec.	
1	Shand and Mason	100	...	3 0		4	Roberts	80	...	12 30	Not filled.
2	Butt and Co..........	100	...	3 3		5	Easton and Amos...	...	...	...	
3	Merryweather	145	...	3 7							

THIRD TRIAL.—*Delivering into large tank.*

Name.	No. of trial.	Time hr.	Time min.	Time sec.	No. of deliveries open.	Length of hose.	Size of nozzle.	Depth from which water is drawn.	Horizontal distance in feet.	Vertical height in feet.	True distance in feet.	Angle from horizon.	Average steam pressure.	Average water pressure.	No. of gallons delivered.	Time of raising steam.	Remarks.
						ft.	in.	ft. in.				deg.	lb.	lb.		min. sec.	
Merryweather ...	1	1	24	55	2	440	1½	16 4	40	40	56	45	91	89	16,086	10 32 to 80 lb.	Fire lighted 4h. 1m. 55s.; gauge moved at 4h. 8m. 20s.; engine started at 4h. 12m. 27s.; water drawn in about 10 revolutions; pumps not primed; valve box leaked slightly; and engine worked satisfactorily in every respect.
Shand and Mason	1	2	0	0	2	440	1½ & 1⅜	16 4	40	40	56	45	96	62	12,917	11 21 to 120 lb.	Fire lighted at 11h. 25m. 6s.; gauge moved at 11h. 32m. 53s.; engine started at 11h. 37m 7s.; pumps primed at 11h. 45m. 48s.; drew water at 11h. 47m 0s.; water first through nozzle 11h. 48m. 59s.; in hood at 11h. 49m. 19s.; shifted nozzle 3¼m. delay (high wind).
Roberts	1	2	0	0	1	420	1¼	16 4	40	40	56	45	75	75	9,936	11 20 to 80 lb.	Fire lighted at 11h. 17m. 0s.; started engine at 11h. 28m 20s.
Butt and Co. ...	1	0	46	50	2	440	1½	16 4	40	40	56	45	78	78	8,280	14 10 to 45 lb.	Fire lighted at 5h. 55m. 0s.; started engine at 6h. 9m. 0s.; repeatedly stopped from slide valve not acting; and stoped entirely at 6h. 46m. 0s., from cylinder cover breaking.
Easton and Amos	1	1	32	35	2	440	1⅜	16 4	40	40	56	45	98	41	3,036	12 30 to 90 lb.	Fire lighted at 2h. 2m. 3s.; gauge moved at 2h. 10m. s.; started engine at 2h. 15m. s.; pumps primed, worked till 2h. 54m. 5s.; stopped to shift; plungers went to work again, and stopped entirely at 3h. 3m. 2s., from 2 fire-bars falling out.
Nichols (Manhattan)	1	1	4	55	2	420	1½	16 4	40	40	56	45	...	...	None.	13 9 to 45 lb.	Fire lighted at 10h. 51m. 14; gauge moved 10h. 59m. 20; drew water directly; steam up to 140 lb. at 11h. 8m. 45s.; stopped 2 minutes; started again, made a few revolutions and fly-wheel broke.

FOURTH TRIAL.—*Vertical jet against tower.*

No.	Name.	Size of jets.	Greatest height thrown.
			Feet.
1	Shand and Mason	22-16ths	180
2	Merryweather	26-16ths	180
3	Roberts	14-16ths	150
4	Lee and Co.	21-16ths	55

Gray's Engine—Lighted fire at 7h. 7m. 40s.; steam 9 lb. at 7h. 17m.; got to work at 7h. 23m. 40s.; to blow fires, 7 h. 27m.; water through hose, owing to some of the pipes connected with the steam guage breaking, no further experiments could be made.

SMALL CLASS CONSISTING OF THE FOLLOWING ENGINES:—

		ton.	cwt.	qr.	lb.
1.	Shand and Mason	1	9	2	0
2.	Lee and Co.	1	10	0	0
3.	Merryweather	1	10	1	12

Delivering 1,000 gallons into a tank at a true distance of 56 ft. and 45 deg. from the horizon. The water in the boilers being cold when the signal was given to commence, each engine commencing to work on obtaining steam pressure of 100 lb. to the square inch.

First Trial.

No.	Names.	Time of raising steam to 100 lb.	Time of filling tank.	Total time.	Remarks.
		min. sec.	min. sec.	min. sec.	
1	Shand and Mason...	11 36	5 24	17 0	
2	Lee and Co.	11 55	6 3	17 58	Owing to a broken bolt, there was great leakage in water cylinder.
3	Merryweather	12 15	9 14	21 29	

Delivering 1,000 gallons into tank at same distance, commencing with full steam.

Second Trial.

No.	Names.	Steam at beginning.	Steam during work.	Time of filling tank.	Remarks.
		lb.		min. sec.	
1	Shand and Mason...	85	...	5 49	
2	Lee and Co.	125	...	5 50	Leakage remedied.
3	Merryweather	100	...	6 17	

Third Trial.—*Delivering into large tank.*

Names.	No.	Time. hr.	min.	sec.	No. of deliveries open.	Length of hose.	Size of nozzle.	Depth from which water is drawn.	Horizontal distance in feet.	Vertical height in feet.	True distance in feet.	Angle from horizon.	Average steam pressure.	Average water pressure.	No. of gallons delivered.	Remarks.
						ft.	in.	ft. in.				deg.	lb.	lb.		
Shand and Mason	1	1	0	0	1	420	1 & 1½	16 4	40	40	56	45	146	80	8,142	Steam ready at 150 lb.; started at 7 h. 3 m. 32 s.; stopped at 7 h. 12 m. 5 s. to put on an additional length of hose; worked well throughout.
Merryweather ...	2	1	0	0	1	420		16 4	40	40	56	45	86	45	4,885	Steam ready at 110 lb.; commenced work at 3 h. 43 m. 30 s.; pumps primed.
Lee and Co.	3	1	0	0	1	420	¾	16 4	40	40	56	45	80	60	4,278	Steam ready; started at 2 h. 1 m.; worked well without any stoppage.

Legal Intelligence.

COURT OF QUEEN'S BENCH, Guildhall, July 8.

(Sittings at Nisi Prius, before the Lord Chief Justice and a Special Jury.)

SAXBY V. STEVENS.

This, although a patent case, was one of singular interest, and may be said, indeed, indirectly to involve the interests of human life itself, the object of the alleged invention being to prevent or diminish the danger of those accidents on railways which cause too frequently such terrible loss of human life. Every one is aware that these accidents arise most often from the mistakes of signalmen or pointsmen; and most persons who have travelled by rail have had at times their attention directed to the peculiar system of signals and points, with many-coloured signal-lamps and the arms of semaphore signals; and, perhaps, now and then, have had a dim idea, when they saw a train stopped, shunted, or shifted, of the immense importance of all this apparently complicated system, and the awful results which might follow on any casual disarrangements of the apparatus; and perhaps, may have had their apprehensions verified next morning by an account of some fearful catastrophe arising from some such cause. It will not be wondered at that mechanical ingenuity should have been tasked to the utmost to avoid these dangers, and preclude the possibility of disarrangement in the signal apparatus; and the plaintiff had taken out a series of patents, beginning in 1854, with a view of securing this great object. The gist of his alleged invention, perhaps, may be thus shortly summed up—the connecting the signals and points by one and the same movement, and that a self-acting movement, caused by the passage of the train itself. The idea, it will be seen, at once is simple and effectual if capable of being carried out; and the degrees in which it had been carried out and invented by the plaintiff was the question now in litigation. In 1856 the plaintiff, describing himself as of "Brighton, Sussex," took out a patent for an invention of a "mode of working simultaneously the points and signals of railways at junctions to prevent accidents," describing his invention as follows:—

"This invention consists of an arrangement of mechanism by which the switches or points, the signal lamps, and the arms of semaphore signals, as used on railways, may be simultaneously actuated by one movement, and in such a manner that the points cannot be wrong when the signals are right, nor the signals wrong when the points are right. Hitherto the signal lamps and the arms of the semaphore signal or telegraph, have been actuated by one movement of the hand of the signalman, while by an arrangement of stirrups for the feet, he was enabled to adjust the points; but this arrangement has led to serious accidents, from want of proper connection between the points, which shift the carriage from one line to another, and the signals which indicate to incoming trains the safety of proceeding, for while the signals have been right the points or switches have been wrong, or *vice versa*, causing collisions and other accidents. By the simultaneous action of my arrangement much greater certainty and safety are attained; and the use of pedals or stirrups for the feet of the signalman are dispensed with."

And the nature and importance of the invention was more particularly described as follows:—

"This invention consists of certain mechanical arrangements, whereby the danger hitherto resulting from the points and signals being actuated by different persons, or by a motion of the feet as well as the hands of the signalman, is avoided. In many instances accidents upon railways have occurred through the negligence or even the absence of the man to whom the charge of the points has been intrusted in such cases—although the signals may be right, and indicate to the engine-driver that the line is clear, in consequence of the points not being properly set, the train will be either directed upon a wrong line or into a siding, and an accident occur before the driver is aware that his train has gone wrong. In the signal apparatus now in use upon some lines of railway the semaphore signals or signal lamps are actuated by a stirrup put in motion by the foot of the signalman, while with his hand he actuates a lever which sets the points. The danger of this arrangement is, that should the attention of the signalman be required to more than one train, as is frequently the case, while setting the signals for both he may forget the points, and an accident arise from that cause. And by the present invention the semaphore signals, the coloured lamps, and the points, are all actuated by the single motion of a lever, thus rendering the duties of the signalman of the most simple character, and thus making it impossible for an accident to arise from the signals and the points differing." Reverting to the history of the case, it may suffice to state that in 1858 the plaintiff took out another patent for improvements in his invention, the object being an apparatus for self-acting distant signals on railway lines to lock simultaneously the signals at the junctions, or main and branch lines, and especially to secure this result—that when the main line distant signal is set to "all right," it shall by a self-acting movement "lock the levers," so as to prevent them from being moved; and in 1860 he took out another and final patent for apparatus perfecting his invention. In the same year a gentleman named Chambers took out a patent to secure the same object, but its nature and the distinction, if any, between his invention and that of the plaintiff, involve chemical details into which we cannot enter. It appeared that in 1859 the defendant had been employed to effect the object at the Willesden junction of the London and North-Western line, where the Government inspector insisted that there should be some signal arrangement comprising the "locking apparatus," under which, when the signal was "all right," the levers should be locked and held fast, so as to prevent the "points" from being moved. In 1860, the plaintiff was employed at the Victoria Station with the same object, and there, it was said, perfected and worked out his invention. The defendant had since then erected some apparatus with the same object at various stations—Strood, Yeovil, Welwyn, &c., and these were alleged to be infringements on the plaintiff's patent. Such was the cause which now came on for trial before a jury of London merchants; and it will be seen, it illustrated in a striking manner the manifest inaptitude of such a tribunal for the trial of a case involving the most intricate and perplexing mechanical details.

Mr. Bovill, Q.C., Mr. Hindmarch, Q.C., Mr. Macrory, and Mr. Talfourd Salter appeared for the plaintiff; Mr. Grove, Q.C., Mr. Goodeve, Mr. Keane, and Mr. Bridgman were for the defendant.

The floor of the court was occupied by large

models exhibiting a line of railway with a junction station and all the signal posts and lamps, and the apparatus of points and levers, most admirably and ingeniously—but, to the uninitiated, unintelligibly—represented.

Mr. Bovill, in opening the case for the plaintiff, entered most zealously and elaborately into the explanations of all the mechanical details of the models, further illustrated by the aid of photographic drawings in the hands of the jury. For an hour and a half the learned counsel laboured away with unflagging energy to make the jury understand, but as he went on it was lamentably apparent that the more he laboured to make them understand, the less they understood, or were likely to understand, and that indeed, as he proceeded, and the case became more and more involved in intricate details, they became more and more hopelessly bewildered. At last, as the learned counsel was entering in the most lively mannner on a new feature of the invention,

The Lord Chief Justice, in mercy to the jury and the parties, remarked that if it was necessary to enter into all these details it certainly would be useless, for it would be impossible that the jury should understand them and carry them all in their heads.

Mr. Bovill said he had himself felt this difficulty; but then it was of course necessary, if the jury were to try the case, to endeavour to make it intelligible to them, and with that view these mechanical details were essential. And accordingly, away went the learned counsel again, plunging into details more and more intricate and involved, all about "cogs," and "levers," and "bars," and "nuts;" and at last, when he came to explain the alleged invention of Mr. Chambers and the distinction between it and that of the plaintiff, calling for a new set of models,

The Lord Chief Justice again interposed, and said,—Surely, if a case were needed to give the *coup de grace* to our present system of trying these patent cases before a jury, this case must suffice for that purpose. If the jury were a body of engineers and mechanicians, it might be possible that they should understand it; but as it is, it is hopeless.

Mr. Bovill repeated that he quite felt the difficulty, and even if he himself, after long and laborious study, had found the greatest difficulty in understanding it, he could not help despairing of the jury being able to do so. Still, there they were, and all he could do was to do the best he could; and so, once more, the learned counsel set to work and went on a little longer, when

The Lord Chief Justice again interposed, and said,—Would it not be better at once to refer the case to some persons skilled in patents?

Mr. Bovill.—No doubt, my Lord, it would be infinitely better to do so.

Mr. Grove quite concurred, and assured his Lordship and the jury that they had not half got to the end, and that there were a great many more "points." (A laugh.)

The Lord Chief Justice said both the learned counsel must be well aware that after many hours or days of wearying labour on the part of the jury it would really be a "toss up" which way the verdict should be; and this was hardly a satisfactory result either to these suitors or all the other suitors of the court. If the case went on it would take up the rest of the sittings, and after all end most unsatisfactorily—probably by an adjournment till next November.

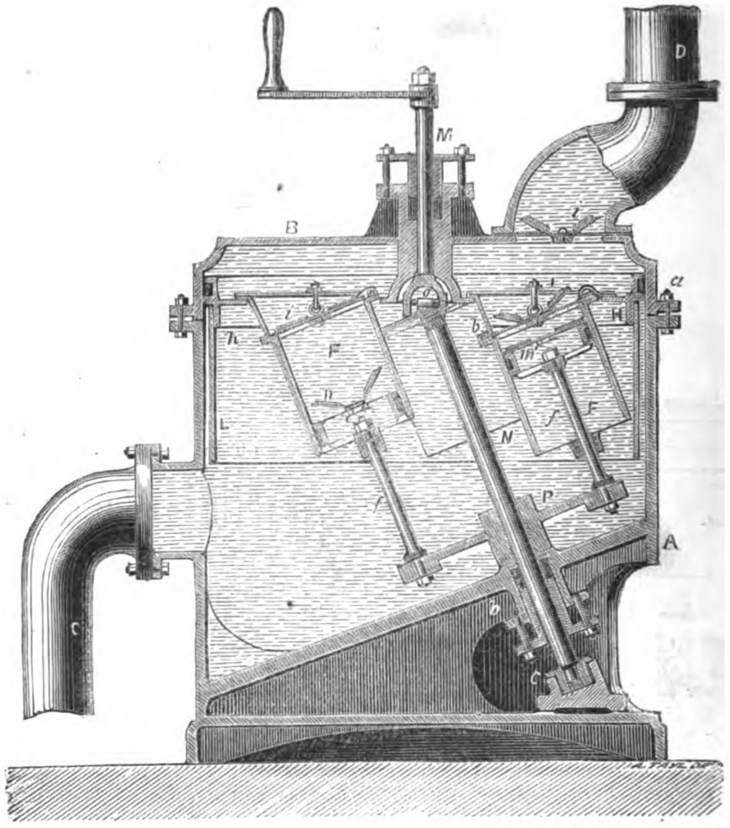
Mr. Bovill said that was no doubt true, and even in the hands of an experienced and skilled referee these patent causes took up many days, and even weeks.

The Lord Chief Justice observed that in the hands of such gentlemen, well skilled in such subjects, and acquainted with such cases, the case would at least end satisfactorily, in a decision in which both parties had confidence; whereas the present mode of trial was really hopeless.

The learned counsel on both sides cordially concurred in that view, and, after consulting with their clients, agreed to refer the case to Mr. Montague Smith, Q.C.

The Lord Chief Justice then dismissed the jury, to their manifest satisfaction.

METIVIER'S PUMP.



METIVIER'S PUMP.

THE following description of this rather novel hydraulic apparatus is extracted from "Le Genie Industriel":—

The mechanism of this pump consists, substantially, of two shafts, inclined under a certain angle to each other, turning in the same direction, and coupled together by a universal joint, the construction of which secures the rotation of both shafts at the same speed.

Upon one of the shafts is fixed a plate, which carries the pump barrels, which are fixed or moveable, according to circumstances; on the other shaft is fixed a plate or cross-bar, on which are mounted the pistons, these last fixed or moveable, according to the arrangement of the pump barrels.

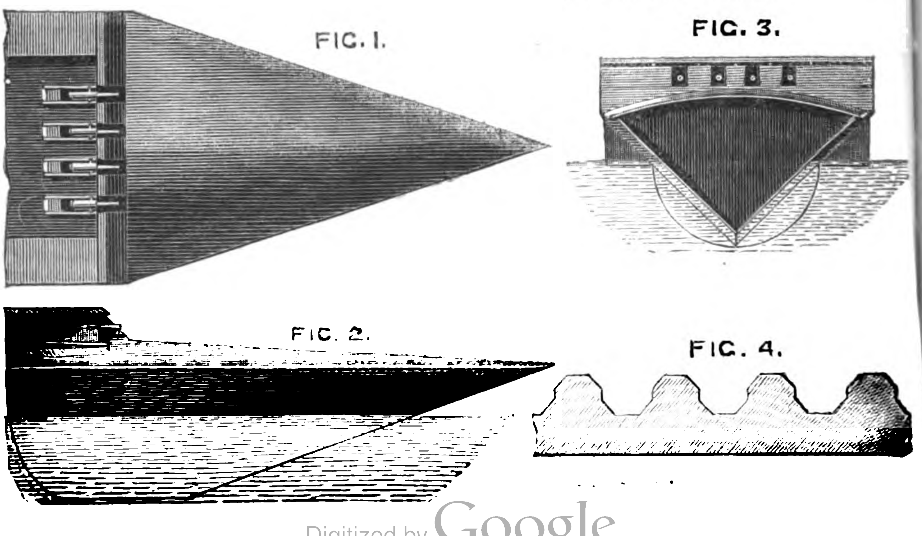
The general construction of this pump will be easily understood by the accompanying drawing.

The apparatus consists of a metal cylinder or vat (*cuve*), made in two distinct parts, the larger marked A, and the lid B; this last being fixed by means of bolts *a* to the vat B, so that it can easily be removed when the machinery requires examination. This vat is fitted with a suction pipe C, and the lid is supplied with the stand or forcing pipe D, each pipe being fitted with a double click valve.

A plate H is fixed on the shaft M, to which the power is communicated, and is fitted with a metallic or hemp packing round its edge, so that it revolves water-tight within the external cylinder A. The shaft M passes through a stuffing box, which is fitted in the cover, and is connected at the lower end with the shaft N, by means of the universal joint *o*. These two shafts form between them a certain angle, and passing through a second stuffing-box, the lower end is supported by and revolves in a foot-step *c*.

To the first plate H are hinged (*relies*) the four pump barrels F, moveable round the bolts I in order that they may accommodate themselves to the angles of their piston rods. Elastic rings are fixed to the upper part of the pumps, in such

CAPTAIN WHEATLEY'S SHIPS OF WAR AND ARMOUR PLATES.



LONGLEY'S BRICK-MAKING MACHINE.

FIG. 1. FIG. 3. FIG. 2.

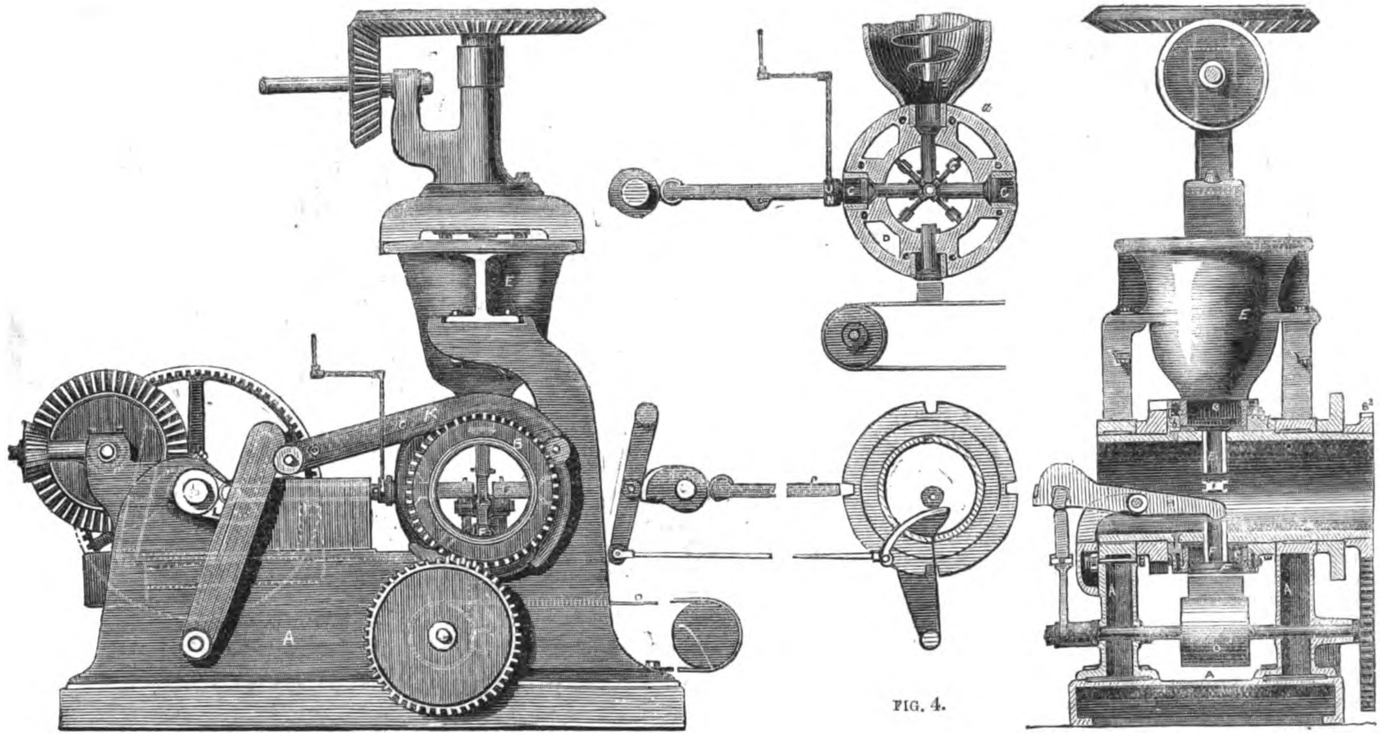


FIG. 4.

a manner that they can only communicate with the space within the lid B through the valves *i*. On the lid is fixed the forcing pipe D. On the inclined shaft N is keyed the cross-bar R, to which are fixed the rods *f* of the four pistons M, which are fitted with valves *n*. The rods *f* are disposed parallel to, and at equal distances from, the shaft M.

The mode of operation is as follows:—By causing the shaft M to perform half a revolution, the same movement is communicated to the shaft N. Now, if we only regard the action of one of the pumps, we find that, in making this semi-revolution, the piston is compelled to travel from one end of the pump to the other, owing to the angle of inclination of the shaft N. The piston, of course, draws an amount of water from the interior of the vessel corresponding to the size of the barrel. In again making another half revolution, the barrel of the pump and its piston return to their first position, forcing the water, in doing so, from the pump into the lid.

The same result is produced during a complete revolution by each pump, alternately drawing and forcing a volume of water proportionate to the diameter of the pistons and the length of their stroke.

CAPTAIN WHEATLEY'S SHIPS OF WAR AND ARMOUR PLATES.

CAPTAIN J. WHEATLEY, of the Royal Navy, has just patented some improvements in the construction of ships of war. He proposes to form the bow of the ship with a sharp projecting grab or crab bow at an angle of about 25 deg. with the keel, and propel the vessel by paddle wheels and screw, or by screws, the wheels when used working independently, so as to steer the vessel thereby. The rudder is to be supported by chocks, acting like a common vice; and in order to be able to mount guns of large calibre and power (say, thirteen inches and twenty tons weight, smooth bore) in or near the centre of the vessel, pointing in a line with the keel, to construct a glacis plated over with armour plates, and over the whole fore part of the vessel, and extending to the front of the paddle boxes. The engravings clearly show how the invention is to be carried out.

Fig. 1 is a plan; fig. 2, a side view partly in section; and fig. 3 a transverse section taken at the line 1, 1, of the fore part of a war vessel, adapted to be propelled by paddle wheels, acting either in conjunction with a screw or screws or otherwise. It will be seen that the guns are placed a little forward of the centre of the vessel, where a casemated battery is formed, rendered shot-proof by armour plates. The guns are mounted on slides, so as to fire through embrasures; they are placed parallel the one to the other, and have no power of training the guns, being laid on to the mark by the steerage of the ship. The form given to the fore part of the ship will cause it on running into another vessel to rise on striking the blow, and then the weight of the ship tends to force under the adverse vessel, and will do so if the blow be struck with sufficient power. The armour-plated glacis will deflect off any shots which may strike it, and will, in most cases, throw them up clear of the battery, as before-mentioned. Two screw chocks are employed, one on each side of the rudder; these being screwed will nip or hold the rudder in a central position, or will support it in any desired position, the chocks being more or less screwed up as may be required.

The second part of the invention consists in a mode of manufacturing armour plates, for which purpose the armour plates are to be rolled or formed with external parallel projecting ribs or latticework, as illustrated in fig. 4, at a distance apart less than the diameter of a shot or projectile which would be thrown against a ship, fort, or battery protected or coated with armour plates, with the knowledge that the same would pass through the plating if of the ordinary construction. As a general rule, it will be found that balls or other projectiles less than four inches diameter cannot be used with effect against armour plates such as are now employed, and therefore if the parallel projecting ribs or latticework have a minimum space between them of less than four inches when using a like quantity of iron in each square foot of the plating, no shot or other projectile which would be used could enter between two neighbouring ribs or lattice openings, so as to strike the surface of the plate on which the projecting ribs or lattices are formed, without first injuring one or both of two neighbouring ribs. In practice, the thickness of the plates on which the projecting parallel ribs are formed, and the thickness of the plate where the ribs or lattices are situated, may be greatly varied, depending on the quantity of iron to be used in each square foot of the armour plates.

LONGLEY'S BRICK-MAKING MACHINE.

THE above engravings illustrate an invention recently patented by Mr. W. Longley, of Leeds. The invention relates to an arrangement of brick-moulding machinery, whereby bricks are produced from "wet" clay, having great solidity with a smooth exterior, and containing a less amount of moisture than those produced by hand or by machinery at present in use.

Fig. 1 is a side elevation of the machine; fig. 2 is a partial end elevation, showing in longitudinal section the cylinder which carries the moulds, and presents them successively to a conical hopper to be fed with clay; fig. 3 is a cross section of the mould cylinder, showing its connection with the hopper; and fig. 4 shows the means used for locking the cylinder, so as to keep the moulds stationary while being filled and discharged.

A, A, is the main framing of the machine, upon which is mounted in suitable bearings a horizontal cylinder B. This cylinder is cast with open ends, and it is fitted near the middle of its length with a series of four moulds, C, C, arranged radially around it. These moulds are formed by recesses cut through the periphery of a projecting band *a*, *a*, that surrounds the cylinder, having their ends closed by the rings *b*, *b*, (bolted to the cylinder) a series of close chambers D, D, are formed in a similar manner between the moulds for receiving steam for heating the moulds. Immediately above this concentric projection of the cylinder B, and in close proximity thereto, is situate the hopper E, in which a screw is mounted for forcing down the clay into the moulds as they are presented to the hopper. Fitted into the moulds are plungers F, the stems of which project through the inner periphery of the cylinder B, and are intended for discharging the bricks from the moulds; the inner periphery of the cylinder B is also pierced to receive the ends of a cruciform arrangement of steam pipes G (fig. 3) for supplying steam from a central pipe running in the direction of the axis of the cylinder to the chambers D; an intermittent axial motion is given to the cylinder, for the purpose of bringing the moulds severally under the hopper to be filled and subsequently under the action of a

rocking presser lever H, for the discharge of the moulded bricks in the following manner:—To one end of the cylinder (outside the framing A) is keyed a kind of ratchet wheel having four teeth, one of which takes into a stud pin fixed to the extremity of a bent arm K, which arm is jointed to a rock lever having its fulcrum on a stud projecting from the side framing. A bowle on this arm K rolls over a track formed by the boss of a cog wheel B^2 (hereafter to be referred to), and thus the smooth working of the ratchet movement in ensured. In the inner face of the lever, a longitudinal recess is cast to receive a guide pin projecting from a crank arm L on a transverse cam shaft, which turns in suitable bearings in the main framing. To the opposite end of this shaft is keyed a cog wheel with internal teeth, into which gears a pinion on the boss of a bevel wheel M, mounted on a stud axle, carried by the ain framing. This wheel M is driven by a bevel pinion, which receives its motion from any prime mover. It will now be understood that for every rotation of the cam shaft, the arm K will be caused to pull round the cylinder B one-fourth of a revolution, and then move forward to bring its stud pin in front of another ratchet tooth. When the uppermost mould C has been filled by the driving down of clay from the hopper E, through the rotation of the propelling screw, this axial motion of the cylinder takes place, and at that moment a knife edge situate at the bottom of the hopper scrapes the lips of the mould clear of clay. The mould is now brought down opposite a horizontal plunger N, and by it the clay is compressed in the mould. The rod of this plunger N slides in a fixed guide, and it is fitted with a bowle which is kept in contact with a cam on the cam shaft by means of a weighted crank lever, with which the plunger rod is connected. As the increasing radius of this cam presses on the bowle, the plunger will be forced forward into the mould presented to it, and compress the clay contained therein. When this is effected, and the cam in its revolution has passed out of action, the weighted crank lever will draw back the plunger N out of the mould. Another movement of the cylinder B will now take place, and the compressed brick will be brought down to the position for being discharged on to an endless apron O. This is effected by the stem of the plunger F of the mould being pressed upon at its rear end by the rock lever H. This rock lever is mounted on a bent bracket arm attached to the main framing, and it is provided with a bowle, which bears upon a rocking cam having a stud pin on the framing for its fulcrum. This rocking cam is jointed to a rod, which connects it with a rocking arm, pendent from a bracket on the framing. The arm carries a bowle which bears against a cam on the cam shaft. The revolution therefore of the cam shaft gives a reciprocating motion to the cam H, thereby causing it to rock the lever H, and depress the plunger that has been brought beneath its inner end. This depression of the plunger effects the discharge of the brick, which is facilitated by the heating of the moulds through the admission of steam as before explained. To prevent the adherence of the clay to the compressing plunger, it is made hollow, and steam is conveyed thereto by an arrangement of jointed steam pipes, as shown at fig. 1. The discharged brick is received on to an endless apron, which receives motion from the spur wheel on the cylinder B, gearing into a spur wheel on the axle of one of the carrying rollers of the endless apron O. The cylinder B is also furnished with a ring in the periphery of which are four notches, corresponding with the moulds. These notches (see fig. 4) are for the purpose of receiving the taper end of a locking bar P, which, when it is desired temporarily to lock the cylinder (as at the moment of filling, pressing, and discharging the moulds) is thrust forward by a cam on the cam shaft pressing upon a bowle, mounted on the end of the locking bar which slides in guides provided to receive it. The release of the cylinder is effected by throwing back the locking bar by means of a weighted crank arm, as in the case of the compressing plunger.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—D. H.—A. D.—T. W.—Messrs. E. and T.—T. W.—J. W. and Co.—W. R.—M. and Son.—E. F.—J. H.—J. R. and M. W.—W. W.

D. K.—Next week.

J. W. (Gosport).—We cannot answer legal questions.

T. H.—Neither of the sketches represent the correct form for the arms of a reaction wheel, which should be so curved as to permit the water to flow in a straight line from the centre of the wheel to the delivery orifices. This curve somewhat resembles an involute. The area of tube should gradually decrease from the centre to the orifices of delivery.

W. K. (Canterbury).—We really cannot advise you: we should like to see your demonstration, but we cannot promise to publish or make any use of it.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

COATING BOILERS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—We are working a boiler 16 ft. long by 6 ft. in diameter, heated by two internal flues, and made of 7-16th in. plates. It is set in brickwork, and covered with sand 4½ in. thick, with one course of bricks thereon. The two ends and one side are enclosed by brick walls, and there is a corrugated iron roof about 6 ft. above the crown of the boiler, supported on one side by the wall, and on the other by iron pillars. The left side of the boiler-house is, of course, open. If we remove the coating of brick and sand from the top, the space left exposed will be about 6 ft. Our engine is 12-horse power; average working pressure 30 lb. to 32 lb. per square inch, with a weekly consumption of slack of about 3½ tons.

We fear that slight escapes of steam from faulty rivets will, by keeping the sand wet, damage the plates by corrosion, if we remove the sand, &c., and leave the top of the boiler exposed (retaining the roof, and if necessary enclosing the now open side). Should you calculate that we should incur any loss in power or fuel from condensation of steam; and if so, to what extent would this be?

We know that the more closely a boiler is covered, the more economical it is in point of fuel; and the question we wish to decide is, whether this economy is counterbalanced by any danger to the boiler by the covering we have on it at present; and whether the additional safety procured by being able to examine the plates (if we remove the coating of sand) will be sufficient to compensate for any additional cost of working which may ensue.

Yours respectfully,

ENQUIRERS.

Wolverhampton, July 7.

[If your boiler is properly made and in good order, there should be no escape of steam from the rivets; and in any case, we see no difficulty whatever in removing the sand from time to time for examination. If you leave so much of your boiler exposed, we have no doubt that you will lose heat. Why not use felt and boards? or turn a plain brick arch over the top without any sand.—ED. M. M.]

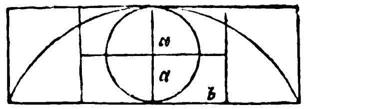
CONSTRUCTION OF A SQUARE EQUAL TO A CIRCLE.

SIR,—I fell upon a pamphlet the other day, which purposes to give to the world a solution of the problem of "squaring the circle" as soon as the author is guaranteed a suitable reward. I do not think I shall damage his prospects of receiving it by pointing out the limits between the possible and the impossible in that problem; which I have not seen done in any mathematical book, though it very likely may have been.

As the area of a circle of radius $a = \pi a^2$, or the radius X half the circumference; and those two things are well known to bear a ratio to each other which is expressible by no finite number of figure in any form, it is evidently impossible either to calculate or to construct a square equal to that circle, without that very quantity π, or the length of the circumference, being contained somewhere in the figures expressing the square. In other words, π can never be eliminated from the result, nor can the square be expressed or constructed by means of any straight lines, derived merely from the radius without actual measurement of the circumference. And this is the sense in which mathematicians rightly deride the attempt to square the circle as an absurdity, if not something more. But it is quite possible to construct by recognized geometrical rules, though by something more than rule and compasses, a square whose area shall be mathematically, and not merely approximately, equal to the area of a given circle.

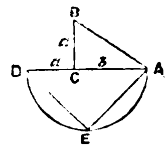
Measuring the length of a circle by a string is hardly a recognized mathematical operation; but the construction of a cycloid is. The base of a cycloid, or the straight line, on which the generating circle rolls while a point in its circumference traces out the cycloid from one point of that straight line to another, is necessarily equal to the circumference of the circle, or $= 2\pi a$.

FIG. 1.



Therefore the rectangle containing the whole cycloid $= 4\pi a^2$; and if the base is divided into four equal parts (b), the rectangle $2ab =$ the area of the circle; and it only remains to construct a square = that rectangle.

FIG. 2.



Draw $AC = b$, and $CB = a$ at right angles to AC; join AB and prolong AC to D, making $CD = a$; then $AD^2 - AB^2 = a^2 + b^2 + 2ab - (a^2 + b^2) = 2ab$.

Draw a semicircle on AD as diameter, and with centre A and radius $AE = AB$ mark off E in the circumference, and join DE. Then E is a right angle and $DE^2 = AD^2 - AB^2 = 2ab =$ the area of the original circle. That is, DE is the side of the required square, or $= a\sqrt{\pi}$.

E. B. DENISON.

33, Queen-Anne-street, July 6.

P.S.—It has nothing to do with this question; but it is remarkable that, in the length of the cycloid itself, π disappears, or may be said to have been rolled out; for the length simply = 4 times the diameter of the generating circle.

A NEW RAILWAY SIGNAL.

SIR,—Will you allow me a space in your widely-circulated journal to correct a paragraph which appeared in your last number, relating to a new railway signal.

On comparing the description, in the paragraph alluded to, I find it identical with the principle of my patent, dated April 10, 1862, of which I enclose you a description, which appeared in the *Brighton Gazette*, August 14, 1862, from which it is obvious that the signal you describe is an imitation; moreover, my patent signal has been working more than twelvemonths at the Lover's-walk Junction, on the London, Brighton, and South Coast Railway, and is mounted on the top of a column, with a dial plate of 4 feet in diameter, and is furnished with a hand which rotates backwards, on the treadle being depressed by the flange of the first wheel of the passing train, after which the hand returns to its former position, thus indicating the number of minutes which have elapsed since the train's passage.

The signal is also illuminated at night to show the red, white, and green, transparent signals, during its performance.

I would not have troubled you with this detail, were it not that your paragraph is not only calcu-

lated to do me an injustice, but to mislead the public as to who is the true inventor.

I am, yours obediently,
EDWARD FUNNELL.

54, East-street, Brighton, July 6, 1863.

INVENTION FOR THE PREVENTION OF COLLISIONS ON RAILWAYS.

Mr. E. Funnell, watch-maker, of this town, has recently patented an entirely new description of self-acting night and day signals for railways, the principal being the indication of time and space between all passing trains, one of which is now and has for some weeks been most satisfactorily tested, at the Lover's-walk Junction, on the Brighton Railway. A model may also be seen at the patentee's, 54, East-street. This invention consists, first, of a cast-iron, hollow pillar, fixed near the left hand side rail, on the top of which is a dial plate, varying from three, four, and five feet in diameter, divided to mark the time of ten minutes on the lower half of the dial—viz., five red spots on the right, indicating danger; and five green spots on the left, indicating caution, or any number of minutes required suitable to the positions in which they are fixed, and is also furnished with an indicator or hand, which rotates from left to right, and from right to left. On the upper portion of the dial is fixed a lens, through which the different colours for night or fog signals are given by the aid of gas or lamp. The mechanism is also fixed to the top of the pillar and back of the dial, which consists of iron framework, two wheels, pendulum, weight, and a quadrant-shaped disc, on which are fixed red and green glasses. A case at the back of the dial encloses the whole of the works; they require no manual attention except oiling once or twice a year. The working of the instrument is produced in the following manner: The first wheel of the passing train depresses a lever placed at the inner side of the left-hand rail, which is communicated to a mechanism by a rod passing up the pillar, and re-winds the weight, rotates the hand backwards to the right side of the dial, parallel across the centre, and replaces the red light for the night-signal simultaneously, both of which indicate danger, and remain locked until the last carriage has passed; after which the pendulum vibrates ten minutes, the hand commences returning to its former position, and, on arriving at the fifth minute discharges the red light, and the green light appears, until the hand has arrived at the tenth minute, by which time the green light will disappear and a bright light remains, with the hand at rest parallel across the left side of the dial until another passing trains repeats its movements, and, should another train pass at any minute during its movements, the hand will return as before described, and also the red light; and, should a train stop at the signal, it will indicate danger during the whole time; or, should a break down occur to a train between the signals, the approach of a train on the up or down line can be stopped by a person pulling a wire, which will make the signals show danger for any length of time required. If the gas be laid all along the lines, the lights of a range of signals can be regulated by station masters, in case of fog or nightfall, and in the morning can be turned down to a small light. The inventor points out the great advantages railway companies will derive by adopting these signals at every mile distance, as it will prove the saving of large sums per year, and also avoid the destruction of life and property.

[The paragraph to which our correspondent alludes was extracted from a Doncaster paper. We regret that through inadvertance we did not quote our authority.—ED. M.M.]

ON INDIAN RIVER STEAMERS.

SIR,—I have read with much interest the article in your valuable journal on the above subject. I gave some attention to the subject in 1860, when I was informed by a gentleman from India that Bourne's train had proved a failure.

Under the peculiar circumstances of Indian river navigation, the same means of obtaining speed as are adopted in deep water cannot be used. Great displacement with very small draught and moderate length are imperative requirements.

Perhaps most of your readers will remember Mr. Scott Russell's remarble experiments with vessels in shallow water. Bearing those experiments in mind, I did not expect that the "Stanley," built by him, would realize the same speed in Indian inland waters that she did in the Thames, and the result proved that I was correct, and tended to corroborate Mr. Scott Russell's own theory. I therefore designed a form of bow which could not be subject to any wave theory, and which I then thought, and still think, would be found to be the best form that could be adopted, and I proceeded to patent it, but, as I received no encouragement from any of the companies, I let the patent drop. The stern of the vessel I proposed to be of the ordinary spoon shape; the body perfectly rectangular; and, of course, the bottom perfectly flat—the flat bottom being continued to the extreme fore end of the stem, where it forms a sharp horizontal cutwater, the upper part of the bow being so formed as to raise the water in a manner very similar to the action of a plough in the soil; the water being lifted and thrown outside by the motion of the vessel. With this form of vessel Mr. Leys' co-efficient of fineness is quite sufficient. My models were shown to several gentlemen from India, well acquainted with the navigation, and highly approved of by them; and the models were finally deposited at Gresham-house, Old Broad-street.

I think that large engines have facilitated the ruin of most Indian river boats. Instead of Mr. Leys' proposed engines, I would use engines of the locomotive class, working at 120 lb. to the square inch, with a piston speed of from 900 to 1,200 ft. per minute; the engine shaft to revolve about three times as fast as the paddle wheels; the engine shaft to have a small wheel fitted gearing into a toothed wheel on the paddle shaft; the exhaust to pass into two surface condensers formed, each of a bundle of tubes right abaft each paddle wheel, so that the spray from the paddle wheels would keep every tube wet; the steam to pass inside the tubes; the tubes to be closed at the outer ends; the condensation to be accomplished *under pressure* if necessary, say at 5 lb. to the inch. With this back pressure to the exhaust, the condenser tubes would give off the surplus heat at 228 degrees very readily, and return the water at boiling point to the boiler; and the back pressure would not be of any great moment when working at 120 lb. in the boiler, and taking into consideration the great importance of supplying. the boiler with distilled water.

The *steering* I would accomplish by a small transverse paddle wheel astern, with a small pair of engines fitted to one crank.

I may add the fact that the above form of bow is well adapted to run into sand banks, so numerous in Indian rivers, and to back out of them easily. The horizontal cutwater will be slightly depressed while running, and will cut its way into a sand bank for a foot or two, when the vessel's motion being stopped the head will rise an inch or two, with a few shovels full of sand upon the bow, and the engines being reversed she will back off at once.

I am, Sir, your very obedient servant,
1, Clifford's-inn, July 6, 1863. T. MOY.

Miscellanea.

Most of the hose employed by the engines at the trial at Sydenham was manufactured by the North British Rubber Company.

The Lords of the Admiralty have abandoned the intention—at least for the presnt—of converting any of the wooden vessels standing on the stocks at Chatham dockyard into iron-clad ships of war.

The *Times*, in commenting on the case of Saxby *v.* Stevens, a report of which will be found in another of our columns, says:—"As we have recently reported a great patent case, Betts *v.* Menzies, which, after being tried three times with contradictory verdicts, and an appeal to the House of Lords on the law, and which, after some five or six years of litigation, has just been sent to a new trial, to recommence a similar costly career of legal inquiry under the system of trial by jury, we may perhaps be permitted to say that our own observation amply confirms that which the learned counsel stated to be the universal opinion of the profession—the utter unfitness of ordinary trial by jury for such cases, and the urgent necessity of some new tribunal for the purpose."

The *Building News*, speaking of the late trial, says:—"We hear that the Americans are not satisfied with the result. They say that a concurrence of circumstances contributed to the temporary failure of their engines, and they have challenged the English makers to meet them in another trial, each competitor to put down £50 or £100. Perhaps, Americans are something like what Napoleon said of Englishmen—they don't know when they are beaten. At all events, we like the pluck of our American cousins, and we hope the challenge will be accepted, and that another trial will soon take place."

A target on the principle of Mr. George Clark, described as consisting of compound dovetailed fastenings and iron cellular backing, was tried at Shoeburyness on Tuesday. The Duke of Somerset, Earl de Grey, and a number of scientific gentlemen were present. The 68-pounders shook some of the bolts and rivets, and two of the shot went through the target, and a salute of four 68-pound shots did further damage. A 150-pound spherical shot, with 50lb. of powder, went clean through the four inches of iron and backing, and cleared away one of the great beams supporting the target. The last shot fired was a 300-pounder steel shell, fired with 35lb. of powder. This went through, between two of the upper plates, lifting the whole of one of the ponderous massive slabs several inches. The general result was not favourable to the principle of construction.

An illustration of the progressive nature of the times has been afforded to the inhabitant of Northampton, during the present week by one of Messrs. Allchin and Son's traction engines steaming through its streets. The engine runs very easily, and can be stopped almost immediately. It is guided by a wheel placed in front of the boiler, the wheel being attached to a chain fixed to the axles, and by this means the engine can be turned from one side of the road to the other as easily as a horse.

A correspondent of the *Sunderland Times* states that the mean level of the sea at Sunderland is 7·50 ft. below what it is at Liverpool. The quay wall at Sunderland is only 8 ft. above high water mark, but the Royal Engineers make it 15·50 ft. above their datum line, which is high-water mark at Liverpool at ordinary spring tides. They were assuming Sunderland sea level to be the same as in the Mersey, and so they calculated the sill of the embarette guns at the battery on Abbs' Head at 69 ft., whereas it is only 61 ft. 3 in. High-water mark at Liverpool is the datum line of the trigonometrical survey all over the North of England, as high water at London is for the South. On the Ordnance Map, substract 7·50 ft. from any given height to get the actual height above high water at Sunderland.

If we have not yet got the best breech loading gun, it certainly is not from want of experiments. An 18-pounder bronze rifled gun, invented by Mr. Broadwell, has been tried at the Royal Arsenal to test the peculiar gas proof principle involved. The arrangement consists of a peculiarly shaped ring permanently located and self-acting, which is placed block, and acts against a bearing in the gun concentric with the bore. The experiments have been eminently successful.

The editor of the *Oil City Register* has recently paid a visit to the wonderfull flowing oil well in that neighbourhood, which throws every vein yet struck entirely into the shade. He says:—While there, the parties owning it were making preeparations to put on a stop-cock, so as to control it. The first joint of tubing was taken off, and the oil spouted up to a height of 50 ft. with a roar like a hurricane. The stream from the pipe, which was 2½ in., was incessant, and we looked at the scene for an hour or more, and finally had to leave before the stop-cock could be put on. We could form no definite estimate of the capacity of the well. Some estimate it as high as 2,000 barrels, some 1,000; but we are satisfied that it was flowing at the rate, when we saw it, of 1,200 to 1,500 per day. The depth of the well is about 450 ft."

Letters from Alexandria of the 24th ult. state that all hopes of immediately repairing the injured link of the Malta and Alexandria cable have been abandoned. Messrs. Canning and De Santy, the representatives of Messrs. Glass, Elliot, and Co., will return at once to England, and Mr. Gibson, Government Inspector, will return to his post at Malta. It was at first inferred that the defect was a mechanical one, and near the shore, if not actually in the harbour at Alexandria. The tests were begun under this impression, but, after a series of careful experiments, the scientific operators were led to change their opinion, and to look for the fault further away, probably close to Benghazi. It is now likely that it will be necessary to obtain the assistance of a steamer from England specially adapted to effect the anticipated repairs, in which case the interruption of telegraphic communication between Alexandria and Benghasi may extend to several months.

An influential and numerous meeting took place on Monday last, at the house of Mr. James M'Connell, C.E., 2, Dean's-yard, Westminster, to consider the system of laying submarine telegraph cables

invented by Captain Jasper Selwyn, R.N. Amongst those present, Lord Shrewsbury, Lord Richard Grosvenor, Sir Edward Belcher, Admiral Duntze, Mr. Henry Danby Seymour, M.P., Mr.W. Gravatt, F.R.S., Mr. Thomas Allan, C.E., Mr. Cornelius Varley, and other well known scientific gentlemen took an active part in the proceedings. Resolutions were passed approving of the principle, and a committee was formed to carry out an experiment with the apparatus.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c.—*none*.
Boilers and Furnaces, 3271.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3250, 3383, 3278, 3279.
Ships and Boats, including their fittings, 3256, 3258, 3276.
Cultivation of the Soil, including agricultural implements and machines, 3259.
Food and Beverages, including apparatus for preparing food for men and animals, 3273, 3289.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 3265, 3274, 8275, 3282, 3284.
Buildings and Building Materials, 3255, 3272.
Lighting, Heating, and Ventilating, 3245, 3254, 3266.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 3246, 3253, 3257, 3261, 3267, 3268, 3269, 3270, 3286, 3287, 3290.
Metals, including apparatus for their manufacture, 3241, 3262.
Chemistry and Photography, 3247, 3249.
Electrical Apparatus—*none*.
Warfare—*none*.
Letter-Press Printing—3277.
Miscellaneous, 3242, 3243, 3248, 3351, 3252, 3230, 3264, 3280, 3281, 3283, 3285, 3188.

3241. A. T. Becks. *Improvements in machinery for cutting or shearing sheets or plates of metal.* Dated December 3, 1862.

This invention consists in arranging and working a series of rotating cutters in the manner hereinafter explained. Two parallel horizontal shafts, situated the one over the other, are driven by steam or other power by means of a pinion on a driving shaft. The said pinion engages with a toothed wheel on the lower shaft, the said toothed wheel engaging with a similar toothed wheel on the upper shaft. Each of the said shafts carries near the end opposite to that on which the toothed wheel is fixed a circular or rotating cutter. These cutters are fixed on the shafts, and their cutting edges meet and cut one side of the plate or sheet or sheets of metal operated upon. The said shafts are hollow, and in the axis of each a screw is situated. A screw nut or box works on the screw in the interior of each hollow shaft. By turning the said screws by a winch, or otherwise, the screw nuts may be made to travel in one or other direction on the screws. A second circular or rotating cutter, capable of a sliding motion, is situated on each shaft, and is connected with the screw nut or box in the shaft through a slot running nearly from end to end of the shaft. By turning the screws the moveable cutters may be made to approach to or recede from the cutters fixed on the shafts, so as to accommodate the distance between the cutters to the width of the plate or sheet or sheets to be cut or sheared. By passing the plate or sheet or sheets of metal through the machine in a horizontal direction, both their edges or sides are simultaneously cut or sheared parallel. The ends of the plate are cut by means of a fifth cutter forming a pair with the fixed cutter on the upper shaft. *Patent completed.*

3242. R. B. Thomas. *An improved apparatus for turning over the leaves of music.* Dated December 3, 1862.

This invention is carried out in the following manner:—To the desk which supports the music the inventor applies a series of wires, capable of turning on a central pin at top and bottom, one of these wires being employed to turn over each leaf of the music. The pin upon which these wires turn over is placed to the left of the centre of the stand, which is the turning point of the leaves, so that the wires being originally placed behind the centre of the leaves (where they have most power), as the leaves turn over slide outwards on to the margin of the leaf, so as not to obstruct a clear view of the notes. Each of these wires is furnished at its lower outer angle with a small wire hook or projection, behind which the lower margin of the leaf is placed, to obviate the liability which a leaf might occasionally have of turning over with the preceding one, and leaving its own wire bare. Each of the wires is also provided with an india-rubber or other spring, having a constant tendency to throw the wire over to the left. On the right hand side of the lower part of the desk, and close to the position the wires assume when turned over to the right, he places a spring catch or bolt of a peculiar construction. This catch is so formed and arranged that, when a wire is turned over to the right, the bolt slides back to let the wire pass, and immediately shoots forwards and retains it, so that in placing a piece of music on the desk, all that is necessary to be done is to place the lower margin of each leaf separately in the hook of its respective wire, and turn the wires successively over to the right, where they are all held by the catch, the first page of the music being uppermost. It will now be evident that, if each of these wires be successively released, its spring will draw it over to the left, carrying its respective leaf with it, but as the sliding back of the catch would release all the wires at once, in order to release only one at a time, the bolt is made capable of an oscillating movement on a centre pin, and is provided with a knife edge projecting the thickness of one wire from the back of the catch. As the catch oscillates on its centre pin, the knife edge first passes behind the front wire retaining all the rest, and the front part of the catch then releases the first wire, and allows its respective spring to turn over the first leaf, and so on releasing one wire at a time at each oscillation of the spring catch. The oscillation of the catch is effected by means of a string or wire which may either be pulled by the hand or connected to a pedal, and worked by the foot. *Patent abandoned.*

3243. C. F. Claus. *Improvements in carboy hampers, and in the machinery or other means used for manufacturing the same.* Dated December 3, 1862.

This invention consists—1, in substituting hampers made of wire, or even hoop iron, covered or coated with tar, varnish, lead, or alloys of lead, for those now in use made of willow, twigs, cane, &c.; 2, in the means and machinery used for manufacturing the same, which consists in weaving the wire or hoop iron round a metal or wooden mandril representing the shape of the hamper. The invention consists—3, in coating the carboy hampers with lead, or an alloy of tin and lead, or similar alloys. *Patent completed.*

3245. W. H. Browne. *Improvements in gas stoves.* Dated December 3, 1862.

For the purposes of this invention, the inventor arranges over a gas burner of a circular or other form, such as is now commonly employed in gas stoves, a dome, either of fire clay or stone, or other similar mineral material, which is a bad conductor of heat. This dome covers the burner and absorbs the heat produced by the combustion of the gas, which in turn it radiates off and communicates to the air with which it is in contact. There is a hole in the top of the dome to allow the draft from the gas burner to escape upwards. *Patent abandoned.*

3246. J. J. Abadie. *Improvements in the manufacture of imitation lace and gimpure veils and other analogous articles.* Dated December 3, 1862.

This invention has for its object to produce these articles with a better appearance and more resembling real hand-made lace than the imitations at present employed for the purpose. The first improvement consists in manufacturing the spotted or figured groundwork with a plain border of such width that the ornamental or figured border may be attached thereto by sewing or otherwise, without the risk of the pattern being spoiled by a spot or flower of the groundwork interfering with the ornamental border. Another improvement consists in making the ornamental border symmetrical—that is, the flowers, leaves, or other designs of which the border is composed, are made to gradually decrease in size from the central part towards the extremities of the border, and, moreover, the symmetrical curves of the pattern or design are made complementary one to the other on the different sides of the central part—that is to say, if the pattern on one side has curves directed to the right, the pattern on the other side, although of the same character, will have curves directed to the left. This symmetrical arrangement of the pattern of the border is produced by the arrangement of the pattern cards of the jacquard apparatus, which are specially prepared and arranged in the series to effect this object. The last improvement relates to guipure lace, and consists in weaving into the fabric a stout thread or threads to which the ground threads will be secured, so that, when the piece is divided up, the stout threads thus introduced will form a kind of selvage, whereby the guipure may be connected to the ground fabric which it is intended to ornament. *Patent abandoned.*

3247. A. F. Eden. *Improvements in apparatus for taking minute photographic pictures and magnified pictures of microscopic objects.* Dated December 3, 1862.

This invention consist—1, In adapting to the object end of the camera a small removeable box or dark chamber, in which is placed the glass plate with the sensitive surface when it is desired to obtain a minute photographic picture. In order to obtain an enlarged or magnified picture of a microscopic object, the latter is placed in the small removeable dark chamber, and light is admitted throughout a proper aperture, and allowed to pass through the object, and also through an arrangement of lenses which will throw the magnified image on to a sensitive surface placed at the proper focal length behind. From this explanation, it will be understood that this small box or dark chamber performs a double office, depending upon the nature of the operation that is to be performed. To facilitate the operations of the photographer, this box or dark chamber is made to work in guides or dovetailed grooves, so that it may be easily removed from the camera and replaced when required. Another improvement consists in placing behind the lens, and in front of the negative, a stop with a very small aperture, in contradistinction to the large apertures of the ordinary stops. The patentee finds by experience that, for producing good results in making micro-photographs, the aperture of the stop should not exceed the fiftieth of an inch in diameter, and that, in good lights and under favourable circumstances, a much smaller aperture may be advantageously employed. Another improvement consists in adapting to the object end of the camera a focussing lens, which is screwed on to the small removeable box or dark chamber, and is adjusted by means of a sliding tube. *Patent completed.*

3248. C. H. Roeckner. *An improved method of constructing coffer-dams and other similar structures for enclosing or keeping back the flow of water and preventing inundations, and apparatus for raising and lowering weights.* Dated December 4, 1862.

This invention consists in driving piles across the bed of a river or other watercourse at some distance from each other—say 2 ft., 3ft., or 4 ft. apart—and, according to circumstances, instead of driving the said piles close together in two or more rows, and running clay between, as hitherto practised. To obviate the use of clay, the inventor proposes to employ a strong woven material or fabric, such as a sail cloth rendered waterproof by any known means. This fabric he stretches across the entire line of piles, and he proposes that the depth of the said fabric be considerably more than the depth of the river or other watercourse from the top of the said piles, in order that a part of the said fabric shall lie on the bed of the river or other watercourse. *Patent abandoned.*

3249. H. Swan. *Improvements in stereoscopic apparatus.* Dated December 4, 1862.

According to this invention, the patentee combines stereoscopic pictures with pieces of glass or transparent crystal of suitable form, in such manner that the pictures which are in fact depicted on the exterior of the glass or crystal, or on surfaces placed in contact with, or at a small distance from them, shall produce an image apparently solid and imbedded in a glass or crystal. *Patent completed.*

3250. J. Grant. *Improvements in the construction of turn-tables for portable railways.* Dated December 4, 1862.

This invention consists in a novel mode of constructing a very light and portable turn-table, so that it may be easily moved from place to place, and very easily and quickly placed in position upon the surface of the ground, without requiring to be let into it, and so that four-wheeled carriages or trucks may be turned thereon, so as to be brought at any required angle to their former track, and in a line with any one of any number of branch lines or turn-outs that may be radiating from the centre of the turn-table, or so as to be turned completely round in the direct track. *Patent completed.*

3251. R. D. Kay. *Improvements in the manufacture or finishing of endless machine blankets, or endless lappings for printing purposes.* Dated December 4, 1862.

The patentee, in carrying out this invention, takes an endless fabric of wool, cotton, or linen, or of a combination of all or any of those materials, and which has been woven endless of a given length or circumference and width, in a manner well-known amongst manufacturers of endless fabrics; or he takes an endless fabric of the same material or materials as above, separate or combined, which has been woven as a piece with ends, the warp thread ends of which piece have been twisted together so as to form an endless fabric, in a manner also well-known amongst manufacturers of endless fabrics; and he applies equally over the outer and inner surface of such endless fabrics, or over either surface thereof, a coating consisting of india rubber, or of a compound of india rubber and other substances, and when so coated (if necessary), he applies as a covering to either or both surfaces a woven fabric consisting of cotton, linen, or wool, either separate or combined, likewise coated with india rubber, or with such compound as aforesaid. The coating of such an endless fabric may be effected with a brush, doctor, knife, or roller. He applies the coated covering-fabric first to the outer, and then, if necessary, to the inner surface of the endless fabric, by pressure with rollers, or other suitable tools or instruments. *Patent completed.*

3252. J. Braddock. *Certain improvements in machinery or apparatus for effecting the separation of impurities from the water employed in steam boilers, and also for effecting the circulation of the said water.* Dated December 4, 1862.

This invention relates to the cleansing of water employed in steam boilers, and in separating the floaing particles, impurities, or extraneous matters therefrom by allowing the impure matter to subside or fall to the bottom of a chamber within the boiler, where it can deposit in the form of a sediment, without being disturbed by the motion caused by ebullition. The improvement consists in the application of the steam in the boiler to raise the water from the bottom of the boiler to the said chamber situated partly or entirely above the water line. *Patent completed.*

3253. F. D. Dely and T. C. Gibson. *Improved means and apparatus, whereby petroleum and other oils and hydrocarbons can be safely carried and stored.* Dated December 4, 1862.

The main feature of this invention is the use of a water or other inodorous liquid seal for the end of a pipe or pipes communicating with a tank or tanks, vessel or vessels, containing the oil. *Patent abandoned.*

3254. G. Lewal. *A hot air apparatus in cast iron or in any other metal or substance consisting of prismatic tubes, to be applied to chimneys with flues and heat conduits.* (A communication.) Dated December 4, 1862.

This apparatus consists of a box, in the bottom or lower side of which there is a hole to communicate with the external air, and in the top or upper side a grating pierced with three or more ranges of square holes diagonally, and to each of these holes is adapted a vertical tube, all communicating with a cylinder placed parallel with the box. The cylinder communicates with the apartment either by having the ends open, or by extra pipes, so as to make the openings into the apartment wherever it is desired, but which openings should be on a higher level than the cylinder. The apparatus thus constructed is placed in the inside of the chimney over an air-hole made to communicate with the external air by means of a pipe, flue, or any other means, so that the hole in the bottom of the box corresponds with the said air-hole. The apparatus is placed in the chimney slantingly, so that the bottom should be about 1 ft., and the top about 3 in. from the front of the stove or grate, and would replace the backs now in use of such stoves or grates. The principle of the invention is to divide the heat produced by combustion, and make it work round the tubes, and thus increase the heating surface, so as to utilize the whole heat produced by the fire, therefore there should be several tubes, although the number is a matter to be determined by the size of the chimney. *Patent completed.*

3255. H. CASTELBON. *An improved press to be used in the manufacture of tiles and bricks.* (A communication.) Dated December 4, 1862.

The press, the subject of this invention, is composed of the following parts:—A main framing carrying the press, a second framing serving as guide to the coffin, or upper mould corner, and three shafts. The first shaft carries a fly-wheel and transmits motion on to the second shaft, which gives a come-and-go motion to the coffin, and, consequently, to the upper mould by means of a connecting rod. The third shaft carries a wheel on which the lower moulds are placed. There is a mould or rectangular box intended to receive and mould the clay; also a second connecting rod giving intermittent quarterly turns to the wheel which carries the lower moulds, and a balance-catch working the ratchets of another connecting rod, on which is a rack regulating the stopping. A cake of clay being deposited, the second shaft is made to turn and draw the coffin or upper mould carrier, which presses the cake of clay, and gives it the required form, while the slide bars prepared a fresh supply of clay, which is cut and brought forward by a moveable apron arranged to fall under the second mould when it has arrived at the proper point. The tiles or bricks are thus prepared, and while the upper mould rises again, the connecting rod completing its journey turns a pinion carrying the balance catch, which comes against one of the branches of the ratchet of a cross-bar wheel, thus giving motion to the shaft carrying the wheel which is to bring another bed beneath the upper mould, and which then turns. This machine itself prepares the clay by means of crushing cylinders or a malaxing barrel. *Patent abandoned.*

3256. J. ROBINSON. *Improvements in the construction of ships and vessels.* Dated December 4, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3257. J. BIGGS, J. JOHNSON, T. RICHARDSON, and T. ARNOLD. *Improvements in the manufacture of warp fabrics.* Dated December 4, 1862.

This invention consists in a mode of manufacturing elastic or looped corded or ribbed fabrics in warp machines. For this purpose the patentees combine two well-known systems of looping of the warped threads on the needles of warp machines. Thus, in making the parallel corded, ribbed, or more prominent parts of a fabric, they employ what is known as the "double lap," and according as they require to make wider or narrower cords or ribs, they produce in succession a greater or less number of courses of double lap, and then, according as they wish to have a wider or narrower space between the succeeding cords or ribs, they produce in succession a larger or smaller number of courses of "single lap;" thus there are to be alternately produced several courses of double lap, to obtain the desired width of cord or rib across the machine, and then two or more courses of single lap between the cords, and thus in regular succession till the desired length of fabric has been made. *Patent completed.*

3258. R. WALLIS. *Improvements in apparatus for loading and unloading vessels, and transporting sacks, casks, and other packages or parcels from one landing place or stage to another, or to or from one warehouse to another.* Dated December 4, 1862.

This invention consists of improvements in apparatus or mechanism whereby goods, merchandize, minerals, and various articles in sacks, casks, or packages may be moved from one place to another by causing the same to be drawn by hauling ropes, or other equivalents, across suitable strong ropes, bands, or chains stretched or extended between two places. *Patent completed.*

3259. A. HORNSBY. *Improvements in apparatus for cutting and pulping turnips and other vegetables.* Dated December 4, 1862.

For the purpose of cutting turnips and other vegetables, the patentee employs a disc or wheel mounted on a horizontal axis, and capable of being caused to rotate by means of a crank handle or otherwise. The roots or vegetables to be cut are placed in a hopper, and rest against the revolving disc or wheel, and this has knives upon it suitable for cutting the roots of vegetables into small pieces; the pieces as they are cut pass through passages left for them in the disc or wheel, and fall down on the other side into another hopper placed to receive them. Up to this point, however, the machine is not new, but such machines, as usually constructed, are defective in that they allow the last slice of the root or vegetable to escape as a single piece much exceeding in size the other pieces; this arises in consequence of its being necessary to leave a space at the bottom of the feeding hopper for the knives on the disc or wheel to pass, and hence, as soon as the root or vegetable is reduced to a slice sufficiently thin to pass this opening, it falls through as a completed slice. Now, according to this invention, the patentee, in the following manner, receives the slices so falling through, and returns them to the feeding hopper, and in this manner he ensures their being properly cut up. Below the bottom of the feeding hopper he places a vertical board or screen parallel to the vessel or disc, and at such a distance from the lower part thereof that the knives will just pass clear; and he also forms a flange projecting inwards on or near the periphery of the disc or wheel. It results from this arrangement that the slices that fall through are retained between the vertical board or screen and the flange on the disc or wheel, and the knives, as they sweep round, bring them up again into the hopper. *Patent completed.*

3260. T. G. WEBB. *Improvements in the manufacture of articles of pressed glass.* Dated December 4, 1862.

This invention relates to articles of capacity formed of flint glass, such as decanters, cruets, pickle jars, and toilets, and consists in a method of producing the bottoms thereof. The method by which the patentee accomplishes it is to form the bottom in a mould separate from that which is used for the upper part. The two portions being thus formed as distinct pieces, may be provided with any design capable of being pressed, after which they are heated (if such heating be required) to the necessary temperature, and united as is practised in joining pieces of glass for ordinary purposes. In order to effect a correct junction, he uses guides, against which to slide the one part, so that it may be adapted to the other centrically. This object may also be attained by leaving the bottom piece in the mould by which it has been formed, and then effecting the junction, the said bottom in such case constituting the guide. *Patent completed.*

3261. M. TILDESLEY and E. SHARPE. *Improvements in the manufacture of earthenware knobs, and in fixing them in spindles used with certain kinds of knobs, in securing the metal mounts upon such knobs, and in apparatus to be employed in certain parts of this manufacture.* Dated December 5, 1862.

This invention refers—1, to the manufacture of earthenware knobs, by moulding them in metal moulds lined with plaster of Paris. The sinking on the back of the knob for the mount and spindle, or for the screw, as the case may be, is formed by employing a plug of fired earthenware surrounded with plaster of Paris, the plaster being protected at the bottom by the form of the plug, which resembles a piston with its rod covered with plaster, which the inventors find less likely to adhere to the moist clay. This sinking they make square in section, by preference. They pierce the holes for the running of metal, which is intended to secure the mount or screw longitudinally in the knob, by employing a peculiar instrument formed similarly to a pair of glove stretchers, with a horizontal pin or stud upon the end of each limb; the tool, when closed, will pass into the sinking for the mount; pressure by the hand then forces the pins or studs laterally into the clay, whence they can be again withdrawn by releasing the pressure. The improvement in securing together the knobs and mounts or screws, consists in employing an alloy of metal run into the holes described. The improvements in the spindles consist in grooving them on all four sides throughout their entire length, by rolling the iron in suitable rolls to any necessary length, and then cutting up the rod thus produced into lengths for each spindle. *Patent abandoned.*

3262. L. CHRISTOPH, W. HAWKSWORTH, and G. P. HARDING. *Improvements in drilling, drawing, and rolling metals, and in the machinery or apparatus to be employed therein.* Dated December 5, 1862.

This invention relates—1, to the drilling of metals, and consists in the application and use of a number of stationary drills made to operate upon several pieces of metal simultaneously, such pieces of metal having a rotating motion imparted to them whilst under the action of the drills, in lieu of the rotary motion being given to the drills themselves, as heretofore. The drills are so shaped in any well-known manner as to clear themselves readily from the fragments of metal or drillings during the drilling operation, and the ordinary well-known means are employed for feeding the drills or the metal onwards as fast as the operation proceeds, the speed varying according to the size of bore under operation. Another portion of this invention relates to the drawing of metals either in a hot or cold state, and consists in the employment for that purpose of a screw spindle, in lieu of the traversing chains hitherto employed in draw benches. *Patent completed.*

3263. E. B. WILSON. *Improvements in railway wheels, and in the mode of manufacturing the same.* Dated December 5, 1862.

This invention relates to a peculiar construction and arrangement of railway wheels, whereby greater economy and simplicity of construction are combined with increased safety in case of fracture of the tire. According to this invention, two discs of the desired size are first prepared by casting in malleable metal, and are then placed in dies and subjected to compression or hammering therein for the purpose of giving them the desired form, whether flat, disced, or corrugated. These dies are also so shaped as to produce a raised annular rim all round, or partly round the circumference of the discs on one side thereof, such rim being either parallel, V-shaped, or of any other sectional form. The tire has corresponding annular grooves formed inside it so as to fit accurately over or into the rims of the two discs, which are placed inside the tire from opposite sides thereof, and may, or may not, be held therein by bolts passing through the discs. The space between the discs may be filled in with india rubber, cork, wood, or other good sound-deadening material. *Patent completed.*

3264. J. E. BLACKWELL. *Improvements in barometers or instruments for measuring altitudes, or the pressure of the atmosphere or elastic fluids.* Dated December 5, 1862.

This invention relates to a novel mode of constructing these instruments, so as as to make them portable, and yet at the same time exceedingly sensitive and accurate. The desired object is effected in some of the improved instruments by a combination of several separate improvements; but, in other instruments, some only of the improvements are comprised. In all the improved instruments, however, the variations in pressure are ascertained by means of elastic vacuum chambers, as in the ordinary aneroid barometer; and the patentee finds it convenient to employ four or more elastic chambers arranged in groups or sets, so that the inequalities of pressure or inaccuracies of action in any of the several chambers shall be compensated by the others. In all the instruments these vacuum chambers are directly attached to or connected with helical or other springs, the power or elastic force of which has been previously ascertained with great care, and which reciprocate the expansion or compression of the chambers accordingly as they are acted upon by diminished or increased pressure. *Patent completed.*

3265. J. M. RIGBY. *Improvements in presses for pressing cotton or other fibrous materials.* Dated December 5, 1862.

This invention consists of an improved construction of a portable hand press, adapted for pressing small bales of cotton or material preparatory to the final pressing by hydraulic apparatus. The outer box or framework with the press head and pressing plate are made of suitable materials in any desired manner. At the top of the framework at each end, the inventor employs a shaft, having fixed to it a ratchet-wheel and two sets or series of teeth, which enter the links of strong chains, or gear into racks connected at one end to bars in contact with the under surface of the pressing plate. Each of the aforesaid shafts is made the fulcrum of a long lever, carrying a ratchet for acting on the ratchet wheel, so that when the levers are moved up and down, the ratchet wheels are turned, and with them the shafts and teeth, by which means the chains or racks and pressing plate are gradually pulled up and press the material. *Patent abandoned.*

3266. P. COWAN. *An improved method of purifying gas.* Dated December 5, 1862.

The object of this invention is the purifying of gas, and the invention consists in the employment, for that purpose, of animal charcoal, or of vegetable charcoal, or of other form of carbon. The inventor places the charcoal or carbon in purifying vessels of the ordinary or other form, into which he conveys the gas. From these vessels the gas is conducted, the charcoal or carbon having removed the impurities from it. *Patent abandoned.*

3267. W. J. SMITH. *Improvements in the manufacture of collars, cuffs, and wristbands.* Dated December 5, 1862.

This invention consists in making collars and cuffs, or wristbands, of india rubber, and by preference of vulcanized india rubber. Such collars, cuffs, or wristbands are intended to take the place of the ordinary collars, cuffs, or wristbands now made of cotton or linen, or such like fabrics. *Patent completed.*

3268. E. WALTON. *An improved article of wearing apparel for the neck.* Dated December 5, 1862.

This article of wearing apparel consists of portions of a collar and of a tie or scarf combined in one. The inventor takes a length of washable or other material suitable for scarfs, and hollows it for a certain portion towards the central part, and on one side of the material into a curve to suit the neck. He then sews on to those parts which when worn come in front and at the sides of the neck of the wearer pieces of linen stitched to resemble portions of an ordinary collar, while he applies a stitched band of linen extending round the back of the neck on the upper part of the material forming the scarf or tie. This combined article, when on the wearer, has the appearance of an ordinary collar and scarf. *Patent abandoned.*

3269. C. GALLETI and F. STEFANO. *Improvements in articles of furniture.* Dated December 5, 1862.

This invention relates to a combination of parts whereby the inventors are enabled to make either a table (dining table by preference) or a whatnot at pleasure. The several stages or trays of the whatnot correspond with the leaves or flaps that form the table, and which may be two, three, or more in number, according to the size of the table required. The one end of the dining table is supported on two feet somewhat like the feet of an occasional table, which feet form the sole support when converted into a whatnot. In this end of the table they place a drawer, which, when used as a whatnot, forms the lower shelf with drawer therein. The flaps or shelves are connected together by rods jointed thereto, and so arranged that it is simply necessary to raise the proper end of the table till the connecting rods (which, when as a table are in pairs, close together and form the two side rails of the table) are in an upright position, and form the four uprights or corner pillars of the whatnot, the several leaves of the table keeping the whole time in their horizontal position, and assuming the proper position for the shelves of the whatnot. The reverse movement converts the whatnot into a table; suitable legs are fixed to one of the shelves to support the other end, which, when raised as a whatnot, come up behind it. When as a whatnot, the inventors secure it in that form by a locking action applied to the parts jointed together. *Patent abandoned.*

3270. H. A. BONNEVILLE. *Improvements in the fabrication of stockings and socks.* (A communication.) Dated December 6, 1862.

This invention consists in making stockings and socks tapered and proportioned without seams, and stockings and socks cut to the necessary shape, and joined equally without seams, by means—1, of a new method of applying the rectilinear stocking frame, the ordinary circular frames, and Delarothière's tapering machine; 2, by means of some newly-invented stitching processes, named "Bezard's stitching process," which are substituted for the seams in uniting any kinds of meshed fabrics, woven or otherwise, either with or without selvages; 3, by means of a foot, which, although made on a circular frame, is narrower than the leg, with diminutions at the instep, or with a pattern having that appearance; 4, by means of a tapered and selvaged heel without seams; 5, by means of a new application of hand-stitching for finishing the extremities of the toes and heels; 6, by means of a sort of pattern imitating contractions, which may be changed at will, and which are made with the selvages at the toes, the calf, and the instep, as well as the imitation of the instep on the circular frame. *Patent completed.*

3271. R. THORP. *Improved coating or covering for steam boilers and other surfaces to prevent the radiation of heat.* Dated December 6, 1862.

This invention for the covering of steam boilers and other like surfaces, to prevent the radiation of heat, consists in enclosing the external portion of the boiler or other surface with a covering of sheet iron, or other suitable metal, so as to form a cavity between the outer surface of the boiler or other surface and the inner surface of the sheet metal, filling the cavity with dry sand (by preference sea sand), and in covering the outer surface of the metallic casing with a skin or coating of plaster of Paris, or other like suitable non-conducting material, and which it is preferred to case in, or cover with, wood lagging. *Patent abandoned.*

3272. J. and M. CRAIG. *Improvements in apparatus for the manufacture of clay.* Dated December 6, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3273. G. WRIGHT. *Certain improvements in the preparation and manufacture of food for cattle.* Dated December 6, 1862.

The patentee claims the preparation and manufacture of a cake for feeding cattle compounded of a nutritive oil seed meal base, with one or more condimental elements of a tonic, carminative, stimulative, corrective, antiseptic, or other sanitary character, and likewise the manufacture of oil seed cakes denoting their weight by the means of indentations or perforations upon one or both of their surfaces, as set forth and described. *Patent completed.*

3274. W. McNaught. *Improvements in machinery for washing and drying textile fabrics and materials.* Dated December 6, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3275. J. Campbell. *Improvements in means or apparatus for heckling or hackling flax and other fabrics.* Dated December 6, 1862.

The objects of these improvements is to ensure uniformity in the traverse of the holders carrying the sticks of fibre, and, consequently, in the operation of the teeth or hackles upon the fibre carried by various holders. For this purpose, the patentee applies one or more stops or catches to the traversing means in position to receive the holders and control their position thereon, so as to prevent any of the holders being pushed out of time along such traversing means, and a consequent partial working of the fibre of such holders. *Patent abandoned.*

3276. G. Burchall and E. Borrows. *Improvements in propellers for ships and other navigable vessels.* Dated December 6, 1862.

The object of this invention is to prevent the vibration in ships and vessels fitted with paddle-wheels of the description now in use, to produce or construct propellers less liable to damage from ice and other hard substances in the water, and to obtain, by the use of such propellers increased speed from the employment of an equal amount of motive power. On both sides of ships and other vessels, and in similar positions to the ordinary paddle-wheels, the patentees place one, two, or more propellers, partially immersed in the water, resembling in form the stern submerged screw-propellers generally in use. The blades are sometimes for small and coasting ships cast with the boss, which is secured to the driving shaft, but usually and by preference so formed and secured to the said boss, that the angle at which the said blades enter and leave the water, and the depth of immersion, can be accommodated to the water line. These propeller blades may be secured by bolts or pins to the boss, and strengthened by stays; but, in all cases] they dispense with rings round the outer circumference. *Patent completed.*

3277. E. and W. Ullmer. *Improvements in cylinder printing machines.* Dated December 6, 1862.

This invention consists—1, In obtaining the to-and-fro motions of the printing or type table in cylinder printing machines directly from the driving wheel which is set vertically by means of a connecting rod, one end of which is connected to a pin or stud projecting from the rim of the said wheel, while the other end is attached to the bottom of the printing table. The table has affixed to it a rack which works in combination with a loose wheel on the cylinder shaft for driving the printing cylinder. 2, In holding the printing cylinder in a fixed position during the return of the printing table by a crank or lever attached to the framework of the machine, which lever carries a roller made to travel round a disc keyed on the cylinder shaft, and to engage into a nick or aperture made in the disc. 3, In obtaining the supply of ink for the inking table by means of rollers fitting in slots or grooves in the frame of the machine, which rollers are raised into contact with inking rollers placed above, by inclined blocks or surfaces on the printing table. And, lastly, In obtaining an equal balance on its axis for the cylinder in cylinder printing machines by means of a balance weight fitted to compensate for that portion of the cylinder usually removed. *Patent abandoned.*

3278. R. McClintock. *Improvements in carriage axles.* Dated December 6, 1862.

The objects of this invention are to facilitate the fixing and removal of the wheels, and to diminish friction. Near the outer end of the journal of the axle, the inventor removes a portion from the circumference thereof, and places a split flanged ring or stop in the portion so diminished in circumference; the halves of this ring are kept together by an elastic band which lies in a circular recess cut on the ring. Over this ring, and on the end of the journal of the axle, made square, he places a cap with a broad flange. This cap is secured by a bolt with a threaded end passing through a portion of it and through the flange of, or secured by, one of the halves of the ring; a nut guarded by a moveable button is screwed over the outer end of the bolt of the wheel. The cap and stop lie in a recess hollowed out in the boss or nave. To facilitate and ensure the fixing of the parts, he sometimes causes a tongue to project from the stop and enter a hole bored for its reception in the now removed portion of the journal. To lubricate the axle he applies an oil cup to the collar of the axle, from which the oil flows through a channel made for the purpose and finds its way between the journal and axle box. He prefers to form grooves or channels round the journal. *Patent abandoned.*

3279. R. E. Donovan. *Improvements in the means and apparatus for the prevention of railway accidents.* Dated December 6, 1862.

This invention consists in so arranging one or more plates or bodies, or series of plates or bodies, of metal, wood, or other suitable material, in conjunction with one or more moveable bars, both connected to the carriages, trucks, or locomotive engines of railway trains, that, on a collision taking place, the said bar or bars on coming in contact with another carriage, locomotive, or other obstacle is or are caused to act upon and break, bend, or perforate the said plate or body, or series of plates or bodies, and thus, more or less, gradually expend the force of concussion before the carriage, truck, or locomotive engine can come itself in contact with the obstacle, by which arrangement the engine, carriages, and consequently the passengers contained in the latter, are more or less entirely preserved from injury. *Patent completed.*

3280. J. Jock. *An improved composition or compositions for producing artificial sea-water, or the odour or effects of sea-water.* Dated December 6, 1862.

In carrying out this invention, the inventor uses of bay salt, say one pound; iodine, one drachm; iodide of potassium, one drachm; bromine, six minims; alcohol, one teaspoonful. The process he prefers to adopt is as follows:—The iodine and iodide of potassium are dissolved in, say, half-a-pint of water, and the bromine is added to the solution, which must be kept in a well-stopped bottle or vessel to prevent evaporation or escape of the volatile contents; it must also be kept in a well-stopped bottle to prevent decomposition by light. With this mixture the bay salt is saturated. The bay salt (one pound) is put into a bottle capable of containing double that quantity, and a teaspoonful of the iodine and bromine mixture added thereto. The reason for employing a large bottle or vessel is to allow the perfect admixture of the whole by long-continued agitation. The alcohol is then added, which produces coloured crystals. For bathing, he dissolves a teaspoonful of the crystal with a handful of salt in a quart of water, and adds this solution to a sufficient quantity of water, according to pleasure, for a hip, sponge, or shower-bath, or for a double bath. A bath for total immersion will require two pounds of salt, and a tablespoonful of the crystals. For deodorizing, disinfecting, or tonic purposes, a teaspoonful of the crystals put into a saucer will rapidly pervade a moderate-sized nursery or bed-room with the odour of the sea-coast; the process may be repeated daily, but at the same time proper ventilation should be maintained. *Patent abandoned.*

3281. W. Palliser. *Improvements in screw-bolts.* Dated December 6, 1862.

In currying out this invention, the patentee proposes, in the first place, to reduce the shank of the bolt cylindrically, either in part or throughout the entire length, to the size to which the end is reduced by the screw thread. Instead of this, if it be desirable to do so, he can reduce the bolt in part either about the middle or towards either end; and, supposing it be required that the bolt should thoroughly fill the bolt hole, he can cast zinc or other metal or alloy round the reduced part, and thereby make the bolt of uniform size throughout. In order to diminish as much as possible the amount by which it is necessary that the shank of the bolt should be reduced, he proposes making the screw much shallowed and finer than those in general use. He also prefers that this thread should be of a rounded form, to obviate any tendency there might be in a sharp thread to cause the nut to tear off the end of the bolt. Instead of reducing the shank of the bolt, he can satisfy the conditions above enumerated by forming the screwed part of the bolt of shear steel, or other weldable steel, which he can weld on to the iron bolt in the form of the splice of a fishing rod. He may increase the strength of the steel by tempering it. In the second place, he forms the head of the bolt by rolling or otherwise drawing down the bolt from a bar of iron sufficiently thick to leave the head on the bolt, by means of which the grain of the iron will run in a longitudinal direction. *Patent completed.*

3282. G. Lowry. *Improvements in machinery for hackling flax and preparing to be spun flax, hemp, tow, and such like materials.* Dated December 8, 1862.

This invention consists—1, In a novel combination, arrangement, and adaptation of swivel strippers or stripper rods for the purpose of stripping the tow from the hackles of sheet hackling machines, when and after the hackles have passed through the strike of fibrous material. 2, In an improved method of raising and lowering the gills, needle bars, or fallers of screw gill machines, by the application of an eccentric in conjunction with the bottom screw, and a combination and adaption of levers, the operation of which screw puts into motion a rocking lever to raise or lower the gills or faller bars as may be required. 3, In applying to the improved tow-shaking machine described in the specification of letters patent granted to the present patentee on the 14th day of July, 1862, No. 2016, an apparatus for making laps for tow-carding engines. And, 4, In arranging a perforated ribbed or barrel concentric flexible creeper sheet underneath the working and stripper rollers of tow-carding engines, which creeper carries forward the fibre and allows the dirt, shives, and other impurities to fall to the floor. *Patent completed.*

3283. J. L. Budden. *Improvements in means or apparatus for obtaining and applying motive power for propelling or other purposes.* (A communication.) Dated December 8, 1862.

This invention relates to improvements upon an invention for which letters patent were granted to the present inventor, dated September 22, 1860, No. 2317, for improvements in the application of steam or highly rarified gas or other aeriform fluid to obtain motive power for propelling or other purposes, which invention was communicated to him by Woodford Pilkington. The present improvements consist in the application of a fixed steam guard or guards (by preference of a cylindrical form) to the screw propeller or turbine wheel described in the specification of the patent above referred to, and in the circumference of which the blades or vanes of the screw or turbine wheel revolve. The guard is suitably fixed so as to be entirely independent of the "screw" or "turbine" wheel revolving within it. The inner circumference of this steam guard is furnished with floats or steps which cross the direction of the pitch of the screw, somewhat like the steps of a treadmill, or teeth of a wheel with internal cogs, and upon which the steam or other propelling medium is caused to impinge as it issues from the passages terminating at the periphery of the blade or vanes of the screw or turbine wheel, by which arrangement, in the application of this invention to a submerged screw propeller, the steam or other fluid in discharging is projected against the "steam-guard," in place of going directly into the water, as described in the former specification. *Patent abandoned.*

3284. *Improvements in the manufacture of pulp or half-stuff used in the manufacture of paper, pasteboard, and similar articles.* Dated December 8, 1862.

This invention consists of using the fibrous portion of potatoes either with or without any portion of the skins and farinaceous part thereof, in the manufacture of paper pulp or half-stuff. If used in conjunction with linen or other half-stuff the proportions must be regulated at the discretion of the manufacturer, according to the quality of paper, pasteboard, or similar articles required to be made, because if the whole of the skins are worked up in the pulp, the product will be suitable only for the manufacture of inferior paper or other articles. *Patent completed.*

3285. P. Todd. *Certain improvements in "pickers" used in looms for weaving.* Dated December 8, 1862.

This invention consists in the combination of wood and leather to form such pickers. The leather is the portion arranged to strike the shuttle, and the wood is used as a foundation upon which to fix the leather by means of wire or cement, by which combination the leather tips may be renewed when required, the wood being more durable than leather; thus the whole picker is not destroyed when the striking portion is worn away, as in most instances. This arrangement also enables scrap leather to be employed in the formation of the picker ends. *Patent completed.*

3286. R. A. Brooman. *Improvements in kneading machines.* (A communication.) Dated December 8, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3287. G. A. Huddart. *Improvements in buttons.* Dated December 8, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3288. C. Sanderson. *An improved mode of manufacturing driving bands for driving machinery, lifting weights, and other analogous purposes.* Dated December 8, 1862.

This invention consists in making these articles of thin sheet steel or other metal, cut to the width of the intended driving or lifting band, and coated or protected in a peculiar manner by india rubber, so as to preserve the metal from oxydation. *Patent completed.*

3289. W. E. Newton. *Improvements in preserving animal substances.* Dated December 8, 1862.

This invention relates to novel methods of preserving animal substances by means of chemical agents. These methods differ as to whether the ingredients to be preserved are intended to be employed for alimentary or industrial purposes. For alimentary substances, nitrates of various bases may be employed, in the manner hereafter described, but the neutral nitrate of alumina is preferred. Preference is given to this salt, inasmuch as it does not change the flavour of the meats, does not coagulate the albuminons parts, nor does it in any manner change their alible properties; it is also perfectly innocuous in a hygienic point of view. *Patent abandoned.*

3290. J. Hilliar. *Improvements in hinges, joints, or connections, and in applying them, parts of which improvements may be employed for constructive and decorative purposes.* Dated December 8, 1862.

This invention consists in the manufacture or construction of a joint hinge or connection by using oval or other suitably shaped tubes, such tubes having an opening or slit from end to end. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated February 27, 1863.

557. A. Dudgeon and G. F. L. Meakin, 4, Martin's-lane, Cannon-street, surveyors, and E. E. Allen, 5, Parliament-street, Westminster, engineer. Improvements in the construction of underground railways or subways, and in carriages to be used or worked therein.

Dated May 23, 1863.

1300. F. Potts, tube manufacturer, and J. Key, Birmingham. Improvements in the manufacture of certain descriptions of iron tubing, and in the means of producing and applying an ornamental case to the same, which said means are also applicable to the production of ornaments in metal for other purposes.

Dated May 28, 1863.

1337. C. T. Boutel, Quai Mariemont, Brussels, engineer. A new or improved instrument for measuring distances and altitudes.

1339. C. E. Laederich, Paris, gentleman. Improvements in watches.

1343. F. Osbourn, Peckham, tailor. Improved apparatus for pressing, smoothing, and finishing garments or parts of garments.

1345. T. Jarvis, Earl's-court, chemist. Improvements in obtaining vegetable extracts, and in apparatus employed therein.

1347. W. Needham and J. Kite, patent filter press works, Vauxhall, manufacturers. Improvements in expressing liquid and moisture from substances, and in separating the liquid from the solid portions thereof, applicable also to the filtration of liquids.

Dated May 29, 1863.

1348. E. Ironmonger, Friar-gate, Derby, auctioneer, upholsterer and furniture dealer. An improved loose clip and socket joint, applicable to bedsteads, sofas, chairs, and other articles of furniture and of fencing.

1349. A. Abadie, Fecamp, France, manufacturer. Improvements in railway breaks.

1351. J. J. Pôtel, Saint Quentin, France, engineer. An improved method of accelerating the draft in furnaces and fire-places.

1353. R. Barker, Grafton-road, Upper Holloway, gentleman. Improvements in the manufacture of matches usually termed "Vesuvians."

1355. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the manufacture or preparation of lubricating material. (A communication.)

Dated May 30, 1863.

1359. J. Heard, Crediton, Devon, engineer. Improvements in apparatus for distributing manure.

1361. S. Bates and J. Jardine, Radford, Nottingham, bobbin and carriage manufacturers. Improvements in carriages used in machines employed in the manufacture of lace or other fabrics.

Dated June 1, 1863.

1363. J. Henson, Parliament-street, Westminster, civil engineer. Improvements in the construction of railway carriages.

1365. W. Clark, 53, Chancery-lane, engineer. Improvements in apparatus for printing fabrics, papers, and other surfaces in colours. (A communication.)

1367. L. S. Chichester, Brooklyn, New York. Improvements in means for drying grain.

1369. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved construction of marline spike. (A communication.)

1371. H. C. Coulthard, Park Iron Works, Blackburn, Lancaster, engineer. Improvements in packing for the glands of piston rods and other moving mechanism, where it is necessary to prevent the passage of steam or other fluids.

Dated June 2, 1863.

1373. A. Illingworth, Halifax, boot and shoemaker. Improvements in boots and shoes or similar coverings for the feet, and in the manufacture thereof.

1377. G. A. Barrett, W. Exall, C. J. Andrewes, and A. Barrett, Reading, engineers. Improvements in valves and apparatus for regulating the speed of steam engines. (Partly a communication.)

1379. E. J. Jarry, 29, Boulevart St. Martin, Paris, merchant. Improvements in machinery to be worked by steam or other power for clearing and ploughing land.

1381. R. Crawford, Beith, merchant. Improvements in jacquard machines used for weaving ornamental fabrics.

1383. W. Gleave and T. Young, Manchester, engineers. Certain improvements in apparatus for feeding or supplying water to steam boilers.

Dated June 3, 1863.

1387. G. Davies, 1, Serle-street, Lincoln's-inn, civil engineer. Improvements in machines for "ginning" cotton. (A communication.)

1389. F. S. Barff. An improved means of protecting, preserving, and hardening surfaces of brick, cement, stone, stucco, and other analogous substances, which invention is also applicable to the preservation of timber.

1391. J. Portlock, Hampstead-road, gun maker. An improved alarum apparatus.

Dated June 4, 1863.

1393. S. Blake and T. Lee, Chester, millers, and R. Dutton, Chester, millwright. Improvements in the construction of flour and meal mills.

1397. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the construction of casks, barrels, kegs, and other analogous articles. (A communication.)

Dated June 5, 1863.

1398. S. St. B. Guillaume, 81, Marland-place, Southampton. Improvements in bricks, and in apparatus to be used in manufacturing the same, and in brickwork built therewith.

1399. F. A. Calvert, Manchester, engineer. Certain improvements in steam engines, steam boilers, and steam heating apparatus.

1403. T. Gray, Lower Mitcham, bleacher. Improvements in treating flax, hemp, and other vegetable fibrous substances in order to bleach and separate the fibres.

1405. W. Clark, 53, Chancery-lane, engineer. Improvements in the distillation and separation of hydrocarburets and their derivatives, and in apparatus for the same. (A communication.)

Dated June 8, 1863.

1407. W. A. Brown, 3, Victoria-terrace, Hawks-lane, Canterbury, civil engineer. An indicator for railway trains.

1409. A. J. Hollingsworth, 9, Oxford-street, Southampton. A new or improved spirit-compass with screw lever.

1410. C. E. Newcomen, 20, Ovington-square, Brompton. Improvements in the treatment of peat and other substances containing moisture.

1413. W. C. Brocklehurst, Macclesfield, silk manufacturer, J. Creighton, C. Makinson, and J. Creighton, Manchester, machinists. Certain improvements in machinery or apparatus for winding yarns or threads.

1415. W. Clark, 53, Chancery-lane, engineer. Improvements in mounting and fitting bedsteads, chairs, and other moveable seats on board ship. (A communication.)

1417. E. A. Schofield, Eyam, Derby, boot manufacturer. Improvements in tools or apparatus for paring, rasping, and scraping the edges of boot and shoe soles and heels.

1419. W. E. Gedge, 11, Wellington-street, Strand. Improvements in the construction of kites. (A communication.)

1421. E. Humphrys, Deptford-pier, engineer. Improvements in surface condensers.

1423. H. Reynell, gentleman. Improvements in the manufacture (by the introduction of cocoa-nut husk or part thereof) of a substitute for ordinary felt and kamptulicon, and in utilizing said cocoa-nut husk or part thereof for packing of wine coolers, refrigerators, and ice chests, and caulking of ships and vessels.

1425. W. E. Newton, 66, Chancery-lane. Improvements in nozzles for hose and water-discharge pipes. (A communication.)

1427. T. Page, Adelphi-terrace, Strand, civil engineer. Improvements in propelling vessels, and in apparatus for the same.

Dated June 9, 1863.

1429. B. Dobson, Bolton, machine maker, and D. Greenhalgh, manager. Certain improvements in machinery or apparatus for preparing cotton and other fibrous substances.

1431. C. Niquet, Paris, gentleman. Improvements in apparatus for sorting and washing ores.

1433. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the distillation of bituminous substances. (A communication.)

1435. H. Martin, Surrey-square, Old Kent-road, land agent. Improvements in treating and preparing night soil and sewage with other materials as a manure.

1437. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the propulsion of ships and other vessels. (A communication.)

1439. H. Bessemer, Queen-street-place, New Cannon-street. Improvements in the construction of and mode of working hydrostatic presses and hydraulic apparatus.

Dated June 10, 1863.

1441. R. Aitken, Cambridge-street, Pimlico, civil engineer. Improvements in the permanent way of railways.

1442. T. Adams, 5, Alfred-terrace, Spa-road, Bermondsey. Improvements in slide and other valves, and apparatus connected therewith.

1444. T. Brooke, Bar-street, Laister Dyke. Improvements in miners' lamps.

1445. W. Wells, Manchester, engineer, and J. W. Myers, pattern maker. Improvements in apparatus for obtaining artificial light from volatile liquids or fluids.

1447. W. Clark, 53, Chancery-lane, engineer. Improvements in locomotive apparatus, which is also applicable to other purposes. (A communication.)

Dated June 11, 1863.

1451. M. Henry, 84, Fleet-street, patent agent. Improvements in treating floss silk and silk waste, and in apparatus for the same and other like purposes. (A communication.)

1453. E. Deane, 1, Arthur-street East, London-bridge, engineer. Improvements in cooking and culinary utensils.

1457. W. Walton, Smethwick, coppersmith. An improved pneumatic hammer, useful also for punching and stamping metals.

1458. J. A. Schlumberger, Basle, Switzerland, manufacturing chemist. Improvements in the preparation of aniline dyes or colouring matters for dyeing, staining, or printing textile substances.

1459. W. Seed, Derby-street, Preston, machine maker. Improvements in machinery for drawing, slubbing, roving, and spinning cotton and other fibrous material.

1461. J. Johnson, Peterborough, engineer. Improvements in lubricating apparatus for the cylinders of steam engines.

1463. T. A. Elliott, Enniskillen, Fermanagh, civil engineer. Improvements in reefing topsails and courses.

Dated June 12, 1863.

1464. W. Sims, Reading, brewer. A new compound extract to be employed as a means for the cure of deafness.

1465. F. A. and F. Calvert, Manchester, engineers. Improvements in machinery for burring, ginning, cleaning, and carding cotton and other fibrous substances.

1466. G. Davies, Serle-street, Lincoln's-inn, civil engineer. Improvements in the currying and finishing of leather. (A communication.)

1467. J. Place, Hoddlesden, spinner and manufacturer. An improved combination of materials to be employed for the purposes of sizing and stiffening.

1468. J. C. Wilson, 14A, Cannon-street, civil and mechanical engineer. Improvements in machinery for reducing cocoa-nut kernels and other substances to a state of pulp.

1469. J. C. Wilson, 14A, Cannon-street, civil and mechanical engineer. An improved machine for unhusking rice and other seeds.

1470. G. Bedson, Manchester, manager. Improvements in cupolas and blast furnaces.

1471. T. C. March, St. James's Palace, Westminster, gentleman. Improvements applicable to the ornamentation or decoration of articles of furniture, part of which improvements may also be applied for architectural ornamentation.

1472. T. H. Milner, Edinburgh, gentleman. Improvements in thrashing machines. (A communication.)

1473. R. Hughes, Worcester, road surveyor. An improved implement or apparatus for scraping and sweeping turnpike and other highways, carriage drives, and footwalks, or other places requiring to be so cleaned.

1474. H. S. Barron, Morant Cottage, Blackheath-road, Greenwich, engineer. Improvements in steam fire-engines, parts of which improvements are applicable to steam boilers, and to pumps generally.

1476. G. Davidson, Magie Moss, Aberdeen, paper manufacturer. Improvements in the manufacture of paper bags, and in the machinery employed therein.

1477. J. Jones, Manchester. Improvements in gas regulators.

Dated June 13, 1863.

1478. G. Davies, 1, Serle-street, Lincoln's-inn, civil engineer. An improved mode of oiling journals or axles. (A communication.)

1479. T. Wrigley, Bury, paper manufacturer. Improvements in machinery or apparatus for filtering or cleansing water or other fluids.

1480. J. Hopkinson, Manchester, mechanical engineer. Improvements in the mode of securing or fastening the ends of metal bands, and in machinery for preparing the same.

1481. W. N. Hutchinson, Plymouth, Major-General in Her Majesty's Army. Improvements in means of, and apparatus for, cleansing ships' bottoms and sides.

1483. T. A. Elliott, Enniskillen, civil engineer. Improvements in the construction of and in the means of ballasting ships and other vessels.

1486. M. B. Westhead, Manchester, manufacturer and merchant. Improvements in adapting tapes, ribbons, and other such narrow fabrics or thread to surfaces from which they may be unwound, or upon which they may be rewound.

1487. I. G. and W. Bass, Broughton Little, Cumberland, nail manufacturer. Improvements in the manufacture of nails and spikes.

1488. H. G. W. Wagstaff, Radnor-terrace, tallow melter. Improved apparatus for feeding steam boilers with water, which apparatus is also applicable for raising water.

1489. S. S. Robson, Hendon House, Sunderland. Improvements in apparatus for working the rudders of vessels, and in auxiliary steering apparatus.

1490. J. Shand, Upper Ground-street, Blackfriars-road. Improvements in the arrangement and construction of steam fire-engines, and in boilers for the same, such boilers being applicable to other purposes.

Dated June 15, 1863.

1493. T. Cope, Liverpool, tobacco manufacturer. Improvements in the construction of rocking-horses, and in giving additional motion thereto. (A communication.)

1494. H. B. Barlow, Manchester. Improvements in machinery for opening and cleaning cotton and other fibrous substances. (A communication.)

1495. I. B. Harris, Castle Mills, Fountain-bridge, Edinburgh. Improvements in the manufacture of flexible and other tubes.

1496. J. Juckes, jun., 1, Armaught-road, Roman-road, Old Ford. Improvements in furnaces.

1499. W. Clark, 53, Chancery-lane, engineer. Certain improvements in engines for obtaining motive power from steam or other liquids, also partly applicable to pumps. (A communication.)

1500. P. P. L. Stafford, St. James's-square, Captain in Her Majesty's Indian Army. Improvements in firearms.

Dated June 16, 1862.

1501. J. J. Shedlock, Vincent-street, Westminster, gas engineer. Improvements in valves for the passage of steam, gas, and fluids.

1503. W. Manwaring, Banbury, engineer. Improvements in harvesting machines.

1505. J. Lightfoot, Accrington, chemist. Improvements in fixing mordants in the processes of dyeing and printing textile fabrics or yarns.

1506. J. G. Jennings, Palace-road, Lambeth, sanitary engineer, and M. L. J. Lavater, Bath-street, Newgate-street, rubber manufacturer. Improvements in moulding and vulcanizing articles of india rubber.

1507. W. Score, 30, St. Paul's-road, Camden-town, chemist. Improvements in the manufacture of candles and soap.

1509. A. J. Fraser, Water-lane, Great Tower-street. Improvements in apparatus applied to house and carriage window sashes for the working and fastening thereof.

1510. W. Neill, jun., Bold, near St. Helen's, engineer. Improvements in steam engines.

1511. J. C. Onion, Birmingham, smiths' bellows and patent portable forge manufacturer. Improvements in smiths' and other bellows.

1512. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in protecting or preserving the silvering or quicking on glass, and in the manufacture of glass vessels for silvering or quicking. (A communication.)

Dated June 17, 1863.

1513. W. H. Dawes, Bromford Iron Works, West Bromwich, Stafford, ironmaster. Improvements in the manufacture of iron.

1514. J. Banwell, Watling, Oxford. A combined machine for collecting and placing in rows, or collecting and elevating into a waggon or elsewhere hay, corn, or other agricultural produce.

1515. J. Mills, Sunderland, cordwainer. Improvements in the square rigging of vessels.

1516. J. Newnam, Crayford, Kent, sugar refiner. Improved means of, and apparatus for, boiling in vacuo at a low temperature.

1517. J. F. Spencer, consulting engineer, Newcastle-on-Tyne. Improvements in steam, gas, and water-tube joints.

1521. T. Purdie, 314, Oxford-street. Improvements in the plastering, colouring, and decoration of walls and ceilings.

1523. W. Naylor, Queen's-road, Dalston, engineer. Improvements in apparatus for compressing, holding, and regulating the pressure of gas.

Dated June 18, 1863.

1524. J. A. Sparling, Upper Hornsey-rise, gentleman. Improvements in twisting and winding silk, and in the machinery or apparatus to be employed therein.

1530. R. Jobson, Dudley, Worcester. Improvements in machinery for making moulds to be employed when casting metal.

Dated June 19, 1863.

1532. H. Reynolds, Fleet-street, gentleman. An improved method of rendering atmospheric air fit for illuminating purposes, and of increasing the illuminating power of inflammable gas.

1538. A. Morel, Roubaix, manufacturer. Improvements in traction engines.

1542. M. Henry, 84, Fleet-street. Improvements in decorticating grain and seeds, and in the application of the products obtained by, and materials used in, decorticating. (A communication.)

Dated June 20, 1863.

1546. G. Haseltine, 12, Southampton-buildings, Chancery-lane, civil engineer. An improved oil, more especially designed for mixing paints and colours, and new mode of manufacturing the same. (A communication.)

1550. C. Peterson, Newport, Isle of Wight. A new material or compound applicable to the manufacture of pipes or tubes, to caulking or covering ship's bottoms, and to other useful purposes.

1552. H. Macaulay, Rotherham. Improvements in covers or appliances for the rims, borders, or top edges of chamber utensils, applicable also to commodes and water-closets.

1554. A. T. N. Goll, Caledonian-road, jeweller. Improvements in the manufacture of mountings or settings for precious or other stones.

1556. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in couplings for propelling shafts of ships or vessels.

1558. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in adapting propellers for propelling ships or vessels for ocean navigation.

Dated June 22, 1863.

1564. J. McLean, Dander Hall, West Calder, North Britain, chemist. Improvements in treating oil from shale or other bituminous minerals and similar oils to obtain various products therefrom, and in apparatus therefor.

1568. W. Rowan, Belfast, engineer. Improvements in pistons.

1570. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in adapting propellers for propelling ships.

1572. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in the construction or arrangement of the working parts of engines for actuating the propelling shafts of steam vessels.

1574. C. T. Burgess, Gower-street. Improvements in reaping machines.

Dated June 23, 1863.

1580. T. F. Parsons, chemist, Maindee, Monmouth. Certain improvements in the mode or modes of preparing plates, bars, or other objects of iron for being coated with metal or alloys.

1582. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in steam boilers.

1584. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in the arrangement of apparatus for superheating steam in steam boilers.

1586. A. Mien, Hope Iron Works, Station-street, Stratford. Improvements in apparatus for generating steam.

1588. W. Toovey, 3, Rue de la Pompe, Brussels, lithographic printer. Improvements in photolithography, photozincography, and photographic engraving on copper or steel plates, or on any other suitable substances.

Dated June 24, 1863.

1594. J. L. Hughes, Leek-road, near Joiner-square, Hanley, Staffordshire. Improvements in ornamenting porcelain.

1596. A. E. Brae, Leeds. Improvements in apparatus for actuating domestic bells and other signals by the electric current.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated June 25, 1863.

1599. D. Hussey, Nashua, New Hampshire. Having reference to bobbins and the winding of roving or yarn thereon.

LIST OF SEALED PATENTS.

Sealed July 3, 1863.

13. F. C. Bakewell.	72. C. Worssam.
48. E. V. Gardner.	79. E. T. Hughes.
49. J. G. Dahlke.	87. R. Lilthy.
65. J. H. Johnson.	101. J. Fenby.
69. C. Allen.	135. L. P. Josse.
70. R. T. Monteith.	216. W. Mellor.

Sealed July 7, 1863.

75. C. E. Gray.	390. C. and D. Faulkner, J. Fairley, and W. C. Stiff.
103. D. and J. Tannahill.	913. H. W. Ripley.
105. J. T. Stroud.	283. W. E. Newton.
123. E. Morewood.	1043. A. V. Newton.
203. T. Lambert.	1060. J. and W. Marris.
252. F. W. Wymer.	1075. J. Rowley.
271. C. H. G. Williams.	1125. W. C. Wilkins.
272. A. Pritchard.	1137. A. V. Newton.
288. F. Tolhausen.	

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, July 7, 1863.

490. J. D. and A. P. Welch. Blocking and pressing hats and bonnets.

492. T. R. Harding. Carding and combing flax, wool' cotton, and other fibrous substances.

503. J. W. Burton. Bearings and bushes of axles and bushes of axles and shafts.

509. G. A. Huddart. Imparting heat to fluids.

519. R. A. Brooman. Lamps for burning petroleum and other similar oils, and in feeders or cans for supplying oils to such lamps. (A communication.)

524. B. Lawrence and W. Niblett. Regulating the flow of gas for purposes of illumination.

533. A. Macivor. Veneering or overlaying woods.

534. G. Tomkins. Manufacture of tin and terne plates, and in apparatus to be employed therein.

537. C. Ritchie. Machine for making spiral lighters or spills from wood or other substance.

541. A. P. Price. Blue colours. (A communication.)

545. M. Puddefoot. Implements for tilling and cultivating land.

547. R. J. Nodder. Hats, caps, helmets, military head-dresses, &c.

549. J. H. Albinson and H. H. Cocker. Spinning, doubling, throwing, and reeling silk, and the machinery employed therein.

550. W. Staufen. Fibrous substitute for human and other hair.

553. J. Carver. Arrangement or fixing of combs in machines employed in the manufacture of bobbin net or twist lace.

554. J. A. Coffey. Controlling and facilitating locomotion, whether on land or on water.

557. A. Dudgeon, G. F. L. Meakin, and E. E. Allen. Underground railways or subways, and carriages to be used or worked therein.

560. V. D. Delahaye. Cleaving and excavating pit coal and rock or earth.

561. J. H. Johnson. Machinery or apparatus employed in the preparation or treatment of hemp and other textile materials. (A communication.)

562. B. West. Metallic pens.

568. S. Williamson. Construction of furnaces.

570. E. Paine. Apparatus for facilitating the cleaning of vessels' bottoms while afloat.

571. T. E. Symonds. Screw-propelled ships, and the arrangement and mode of disconnecting, withdrawing, and lifting screw propellers.

574. E. Hayes. Supply water to surface condensers of marine engines.

575. S. Bateman. Manufacture of wire rope and cordage, and the machinery employed therein.

580. A. F. Pagny. Agricultural implement for cultivating tubercles, roots, and all oil plants.

581. G. Hawksley and T. Bissell. Powder chargers.

584. C. Garton. Improved method of applying heat in the manufacture and refining of sugar, and in malting, hop drying, brewing, distilling, and vinegar-making.

599. B. S. Cohen. Apparatus for protecting the points of pencils.

630. C. Clay. Chain harrows.

639. D. W. Ransom. Fixing artificial teeth.

647. J. Cowley. Manufacturing bricks, tiles, pipes, and mouldings.

651. C. H. Lea. Apparatus for opening and closing the gates of railway crossings, which apparatus also acts simultaneously upon the signals.

653. P. Hugon. Obtaining and applying motive power.

668. A. Barclay. Locomotive boring and winding engines.

669. A. Barclay. Traction engines, and apparatus for indicating the pressure of steam.

679. J. Polkinghorne. Treating tin ores, and apparatus for treating ores and matters containing arsenic.

697. W. Young. Type-composing and distributing machines.

703. W. E. Newton. Manufacture of iron and steel. (A communication.)

730. F. Norrington. Girths or bands and knee-caps for horses.

761. W. Clark. Separation or obtaining of ammonia pomazoted matters, and the preparation of manure. (A communication.)

808. B. W. Goode. Journal axle or bearing, particularly applicable to rolls.

821. W. E. Newton. Producing yellow colouring matters and other colours which may be derived therefrom. (A communication.)

842. G. T. Bousfield. Steam boilers. (A communication.)

1163. W. E. Gedge. Manufacture of paper stuff or pulp from certain vegetable substances. (A communication.)

1311. E. Hunt. Posts or pillars for fences and gates. (A communication.)

1361. S. Bates and J. Jardine. Carriages used in manufacture of lace or other fabrics.

1367. L. S. Chichester. Drying grain.

1413. W. C. Brocklehurst, J. Creighton, C. Mankinson, and J. Creighton. Apparatus for winding yarns or threads.

1439. H. Bessemer. Construction of and mode of working hydrostatic presses and hydraulic apparatus.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1593. H. H. Bishop.	1631. W. F. Thomas.
1594. J. A. Salmon.	1633. B. Lambert.
1609. J. Morris.	1636. B. Mitchell.
1613. W. Skinner.	1640. J. Leslie.
1628. W. Hood.	1660. F. C. Warlich.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1531. E. Rogers and H. Mackworth.	1586. R. Shaw.
1578. J. Lewtas and J. Humphreys, jun.	1597. E. C. Healey and E. L. Allen.
	1683. L. Blackstone.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending July 4, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
3166	1 2	3206	0 6	3217	0 10	3231	0 8	3243	0 8	3255	0 4
3180	0 10	3207	0 8	3218	0 4	3232	1 10	3244	0 4	3256	0 8
3198	0 8	3208	0 4	3219	0 4	3333	0 4	3245	0 4	3259	0 10
3199	0 4	3209	0 4	3220	0 10	3234	1 10	3247	0 8	3260	0 4
3200	0 10	3210	0 4	3225	0 4	3235	0 4	3248	0 4	3261	0 4
3201	0 4	3211	0 4	3226	0 4	3237	0 4	3250	0 8	3265	0 4
3202	0 4	3213	0 4	3227	0 4	3238	0 4	3252	0 10	3266	0 4
3203	0 6	3214	0 10	3228	0 4	3239	0 4	3253	0 4	3268	0 4
3204	1 0	3215	0 8	3229	0 4	3240	0 8	3254	0 4	3269	0 4
3205	0 4	3216	0 10	3230	0 4	3242	0 4				

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-bdgs, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.	£ s. d.	p. ct.
IRON:—				
Welsh Bars, in London	per ton	6 5 0 to	6 10 0	2½
Nail Rods	do	7 0 0	7 5 0	
Hoops	do	8 5 0	8 10 0	
Sheets, single	do	9 10 0	9 15 0	
Staffordshire Bars	do	7 10 0	8 0 0	
Bars, in Wales	do	5 10 0	5 17 6	
Rails	do	5 12 6	6 0 0	net
Foundry Pigs, at Glasg, No 1	do	2 10 6	2 15 0	
Swedish Bars	do	11 10 0	12 0 0	2½
STEEL:—				
Swedish Keg, hammered	do	16 0 0	0 0 0	
Swedish Faggot	do	17 0 0	18 0 0	
COPPER:—				
Sheet & Sheathing, & Bolts	do	96 0 0	0 0 0	3
Hammered Bottoms	do	106 0 0	0 0 0	
Flat Bottoms, not Hamrd	do	101 0 0	0 0 0	
Tough Cake and Ingot	do	89 0 0	0 0 0	
Tile Copper	do	89 0 0	0 0 0	
Best Selected	do	92 0 0	0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10	0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½	0 0 8½	
Fine Foreign	per ton	94 0 0	95 0 0	
TIN:—				
English Block	per cwt.	6 2 0	0 0 0	2½
do Bar	do	6 3 0	0 0 0	
do Refined	do	6 8 0	0 0 0	
Banca	do	6 14 0	6 15 0	net
Straits	do	6 7 0	6 10 0	
TIN PLATES:—				
Best Charcoal, I.C.	per box	1 8 6	1 9 6	
Second Quality	do	1 6 6	1 7 6	
Coke	do	1 2 6	1 4 0	
LEAD:—				
Pig, English	per ton	20 10 0	22 15 0	2½
,, Spanish Soft	do	19 17 6	19 10 0	
Shot, Patent	do	23 10 0	0 0 0	
Sheet	do	21 10 0	0 0 0	
White	do	27 0 0	27 10 0	
SPELTER:—				
On the spot	do	17 10 0	17 12 6	net
ZINC:—				
English Sheet	do	23 5 0	0 0 0	3½
QUICKSILVER	per btl.	7 0 0	0 0 0	3
REGULUS OF ANTIMONY:—				
French star	per ton	43 0 0	0 3 0 0	

TIMBER, duty 1s. per load, drawback 1s.

Teak load	£12 0	£13 0	Archangel, yellow	£13 0	£13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
,, yellow pine	3 10	4 10	Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0	Memel	10 0	15 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
,, birch	3 10	4 10	,, white	9 0	9 10
,, elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderhamn	9 10	10 10
,, fir	2 10	3 10	Christiania, per C., 12ft. by 3 by 9 in.		
Memel fir	3 5	3 10			
Riga	3 0	3 5	Christiania, yellow	21 0	23 0
Swedish	2 10	2 15	Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 4
Masts, Quebec red pine	5 0	6 0	PUMICE STONE pr ton	5 10	9 0
,, yellow pine	5 0	6 0	OILS, &c.		
Lathwood, Dantzic, fm	5 10	6 10	Seal, pale ...per tun	47 10	48 0
,, St. Petersburg	8 0	8 10	Sperm body	80 0	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Cod	53 0	54 0
			Whale, Sth Sea, pale	46 0	0 0
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	59 0	59 10
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	46 0	0 0
Yellow pine, per reduced C.			Palm, fine	36 0	0 0
			Linseed	41 15	0 0
Canada, 1st qual.	17 0	18 0	Rapeseed, Eng. pale	47 0	0 0
,, 2nd do.	11 0	12 0	Cottonseed	33 10	35 0

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 17, 1863.

RAILWAY ACCIDENTS.

MR. BENTINCK, by a mental saltation of the strangest kind, has arrived at the conclusion that railway accidents are altogether due to high speed; and having done so, he at once proceeds to enforce his views in the House of Commons. The honourable member's speech, delivered on Friday night, is a remarkable instance of that style of argument which, commencing on false premises, regards individual opinions as proved facts, and gradually leads to the most erroneous conclusions. Not content with the simple statement, conveyed in other words, that speed and danger were nearly synonymous terms, he put all doubt at rest as to what the proper definition of high speed is, by stating that thirty miles an hour was the maximum, to which Government should confine the speed of our trains. "Experience is the foundation of all knowledge," says Bacon. Whether Mr. Bentinck ever read or heard this proposition we do not pretend to say. It is certain that if he has, he has quite forgotten it in these latter days; for all experience goes to show, in such a way too that those who run may read, that the largest proportion of accidents occur to trains which both receive and deserve the epithet "slow" in the fullest sense of the term.

There is but one special casualty to which fast trains are exposed as a consequence o. their speed; that is simply derailment. It may occur from a broken rail, a defective chair, a fractured tyre, or, perhaps more rarely, from an axle giving way. As to collisions of every description, it follows, from the nature of the case, that slow trains are just as much exposed to the chances of such a calamity, as those which are called "express." It is easy enough to see that because a fast train runs into one slower, the circumstance is just as much a result of the tardiness of the one, as of the acceleration of the other. We need not proceed further with this line of argument; every one who has given the matter anything like a little careful study, must be aware that all other accidents, save the one speciality we have mentioned, occur alike to all sorts of trains, fast or slow, goods or express.

Mr. Bentinck's supporters urge, however, that trains leave the rails without anything giving way either in the engines, carriages, or permanent way; that they run off the track, in fact, simply because of the speed, and consequent oscillation of the locomotive, &c., due to the imperfections of the permanent way or the faulty construction of the machine. This is mere assertion, and has little foundation in fact. Not only is it not true that express trains leave the rails more frequently than those which proceed at thirty miles an hour; but it is even more than doubtful that a train ever leaves the rails while things remain in their normal condition. An accident, in the full sense of the expression, is generally attended by such dire destruction, that it is a matter of the most extreme difficulty to determine what was broken or displaced before, and what after, the derailment; and while the warmest defenders of such a proposition must admit that the matter, with a few rare exceptions, is clouded by the mists of uncertainty, we state that all mechanical science and experience, employed synthetically or analytically for the purpose of argument, go to show that a high speed, or, at least, what is called a high speed, is not in itself a sufficient cause to lead directly to derailment. Nevertheless, we admit that the higher the speed, the more likely is it that a locomotive, oscillating violently, may force out a defective chair, or break an over-worked tyre. An accident would follow of course; but even then such a result is due not so much to the speed of the train, as to the defect in the road or the tyre, and that negligence or parsimony which permits such a state of things to exist.

But quitting theoretical argument, let us simply consider that railway statistics prove that express trains, so far from being the most dangerous, are the safest, simply because the greatest possible care is exerted that they shall not be exposed to a class of accidents with which speed has nothing whatever to do. The promoters of a proposal for Government intervention, in questions of speed, signally fail in making their arguments good in the face of such facts.

It seems pretty clearly proved—and that too, alas! by practical demonstrations so lamentable as to rank almost as national calamities—that the speed proposed by Mr. Bentinck, or even one a dozen miles an hour less, is to the full as dangerous as one twice as great. At all events quite as many deaths, and as great a destruction of property have resulted from the one as the other. The question of danger in railway travelling lies too deep for superficial observation, or hasty legislation to reach it.

At one period or another in the history of this strange old England of ours, sumptuary laws ruled paramount, and bore sway over the lieges of the different Sacred Majesties who have sat on the throne, and very difficult to carry out and enforce were these laws—so troublesome, indeed, that very frequently both people and sovereign, voted them a nuisance. And such would we quickly find any sumptuary bill—for such it properly would be—which made thirty miles an hour a maximum pace. So far from railway directors being anxious to increase speed, they hail with delight any means by which it can be reduced without a proportionate loss of public favour. They well know that a permanent way which will easily carry the light locomotive which suffices for slow speed, soon gives way under the tread of the giant racers, which whirl an express to its destination; and a law which removed responsibility, by reducing speed, could not fail to be mischievous to a degree which its promoters little imagine. It would lead to a negligence in the management of traffic, in the condition of the road, in the state of repair of the rolling stock, which would very quickly render a second bill limiting speed to ten miles an hour, necessary to the safety of tha general public. If any bill is ever passed by Government which will have the regulation of railway speed for its object (and we trust our rulers are too sensible to do anything half so foolish), let it be to enforce an increase in speed; such a course would compel such a remodelling of our system, as would secure as much safety at eighty or ninety miles an hour, as we now enjoy at forty or fifty.

Mr. Gibson might well remark that "speed was a relative term." We believe that miles and miles of track may at this moment be found in England, over which a train might be run with safety at 70 or 80 miles an hour, were it possible for an ordinary locomotive of not more than 40 tons weight to attain such a velocity. We also believe (and tremble), that a large proportion of our permanent way, and a great deal of our rolling stock, is quite unfitted for a speed greater than 25 or 30 miles in the same time; and no legislation could be more absurd than that which would pretend to regulate all speed alike, without regard to such facts. There exists no earthly reason whatever, for keeping a track in first-rate order now, but the one—namely, that trains may proceed over it at high speeds with safety. To express speeds, and to these alone, are we to look for the cause of that vigilance, energy, liberality, and attention to minute matters of detail, on which immunity from accidents really depends. Remove this stimulus, and the entire moral standard—if we may use the phrase, of our railway system—will become depreciated, and instead of matters being improved they will be made very much worse. The statistics of the last few years show that, although the number of passengers carried has increased, the number of the deaths by accident is considerably diminished. Thus Mr. Gibson's statement went to show that: In 1861 there were 56 accidents, resulting in the death of 46 passengers, and injuries to 780; in 1862 there were only 52 accidents, with 24 deaths and 537 injuries of passengers. In 1861 the number of passengers carried by railways was 173,000,000. For 1862 he had not the exact returns, but he thought the number carried might be taken at 183,000,000. For the first half of the present year there had been 16 accidents, with 4 deaths of passengers and 165 injuries. Such results demonstrate in the clearest possible manner that Government interference after the fashion proposed by Mr. Bentinck is unnecessary, because growing intelligence, increased knowledge, and, above all, that efficient supervision which directors begin to discover is the only means of avoiding enormous losses, daily strengthens those elements of safety on which alone our security can depend.

The usual definition of the word "accident" implies that it is "an unforseen event," something occurring fortuitously. All the casualties to which railway trains are liable, may be classed under two heads—those to which the term "accident" in the above sense is applicable, and those to which it is not. Thus, a tyre breaking, an engine exploding, a train catching fire, are, as a general rule, accidents in the fullest sense of the term; but collisions of every kind are so obviously the result of some breach of the traffic regulations, that they might often be foretold and calculated on with great ease, long before their occurrence. If a time table is properly drawn up and rigidly observed, it is impossible that two trains can run the one into the other. The observance of these rules in the most perfect manner is, however, an impossibility, and signals are provided to confer those conditions of safety which arbitrary regulations cannot supply. The greater the departure from the times laid down by a traffic superintendent for the arrival and despatch of trains, the greater the work and responsibility thrown on signals and signal-men; and it is not difficult to see that want of punctuality may become so great, that no system of signals invented or worked by fallible man can possibly provide for every contingency. We know what follows.

Railway companies are wisely permitted to draw up their own laws; and, generally speaking, these laws are good and sufficient, and their accurate observance would secure the greatest amount of safety. But railway men know very well that good signalling will permit a certain latitude in the observance of their laws, and directors are, in consequence, prone to gamble with the lives of passengers, and their own property; well knowing that if a

thousand excursion or other trains, despatched without any regard to the conditions of safety, arrive in good preservation at their destination, they will pay for an accident to the thousand-and-first. Here, then, we find the true field for Government interference. Let Parliament so legislate, that while railway companies may regulate their speeds and lay down their own times for departure and arrival, they shall also be compelled, by a proper supervision, to observe these times as far as the capabilities of the locomotives will admit. Trains should leave the termini punctually, and might very easily be compelled to arrive at principal stations with sufficient conformity to time tables to prevent accident. Locomotives would not be overworked; more regular speeds would be maintained; and the comfort, as well as the safety and convenience of the public, would be secured to an extent which, we feel certain, would be so obvious, that such legislation, instead of being considered a vexatious burden, would be pronounced a positive boon.

THE METRICAL SYSTEM.

On the 1st of this month, Mr. Ewart's Bill for decimalizing the existing system of weights and measures and establishing an accordance between them and those of other countries, was read a second time in the House, by a majority of 110 to 75. Now, although we look upon this Bill as in many respects a somewhat crude production, we nevertheless hail its second reading with some satisfaction; as an evidence that the *vis inertiæ* exerted by the British mind when urged towards any new course, is being overcome with regard to this measure. We may therefore hope that the collective wisdom of the nation has stamped its approval on the general principle of the Bill, although we should be sorry to see the House of Commons affirm its details in their entirety, and thrust the measure on the country without further consideration. Anything, however, that will relieve us from the present extravagantly absurd system would be acceptable. We fancy ourselves the practical and common-sense nation *par excellence;* but in what other country on earth are there different weights and measures for almost every different trade; and where else do weights and measures—nominally the same—vary in separate districts of the same kingdom? An enumeration of the different weights, measures, and coins used in Great Britain and Ireland, and our dependencies, would fill a volume, while the useless and chaotic nomenclature would perplex the clearest understanding. Newton, in order to avoid the confusion resulting from English measures, was accustomed to use the old French *toise* or *hexapeda*.

The decimalization of weights, measures, and coins has simply in view the bringing of our common means of estimating the value of material substances under the dominion of our ordinary system of notation; it is merely the complementary result of this system. Had we space we could show—what must be evident on reflection to every arithmetician—that the much-vaunted decimal system of notation is much inferior to the duodecimal system. The importance, however, of universally using the habitual system of arithmetical computation—whatever that system may be—is such, that the decimal system of weights has been adopted for some time in the Mint, the Bank of England, and the Post-office. The grain computed decimally is employed by men of science; the decimal foot has been used for some years by Mr. Whitworth; and English makers of the exact scales used for scientific purposes, generally furnish the kilogramme and its subdivisions in addition to the ordinary weights.

There are, however, several objections to Mr. Ewart's Bill. Leaving out the fact that it is a compulsory measure, and regarding it from a scientific point of view only, we find, first of all, that it leaves the decimal coinage question untouched, and, secondly, that it is based upon the French metrical standard.

A partial decimalization of our usual means of estimating the values of material substances would be a most incomplete proceeding, and in many cases its action would be worse than useless. This was very plainly demonstrated in Lord Overstone's report on the decimal coinage, and it would exceed our limits to follow his reasoning.

The objections we have against the French metre system are by no means founded on an anachronistic sentiment of nationality. There is, in fact, no ground for such a feeling. Although England did not respond to the letter written by Louis XVI., at the request of the National Assembly (1790), inviting the formation of a joint commission of members of the Royal Society and of the Academy of Sciences, to determine the unit of the metre, other countries besides France were represented in the proceedings of the Academy of Sciences. Most of the nations who now use the metre helped to determine its fundamental unit; and the representatives of Spain, Italy, the Netherlands, Denmark, and Switzerland took part in the labours of the Academy of Sciences to accomplish the purpose of the National Assembly. Unfortunately, however, the French and the other commissioners seem to have devoted more attention to the Opera and to politics than to the work they had in hand. It was intended that the ten-millionth part of a quarter of the meridian should be the unit of linear measure; but the commission adopted a standard of length which is only *about* the ten-millionth part of a quarter of the meridian. Now, the quarter of the meridian, as found by Mr. Encke—upon whose calculations are based the labours of the English Ordnance Survey—equals ten million times the metre, *plus* 856 metres. The French metre would thus require a correction of about eight-hundredths of a millimetre.

As the kilogramme is the weight of distilled water at the point of freezing, measured by a cubic decimetre, any change in the linear measure would require an alteration in the official unit of weights. A change in the decimetre, as it must bear upon the three dimensions in the cubic decimetre, would modify the kilogramme three times as much as the metric measure of the cubic decimetre. Thus, if the meridian of Encke, of 10,000,856 metres, be taken as the standard, the kilogramme would have to be increased by no less than 257 milligrammes.

The occurrence of this unfortunate mistake of the International Commission of 1791 has, of course, been ascertained long ago in this country; but, according to a communication from Monsieur Babinet, the well-known member of the *Institut*, lately addressed to one of our foreign contemporaries, the state of things is much worse than was generally believed. He considers it very doubtful whether the kilogramme of the Archives—the official kilogramme for the whole world—is really the exact weight of a volume of water equal to the cubic decimetre of the standard metre in the Archives. Most of the work in the determination of the standards was executed by the instrument-maker Fortin, whom M. Babinet scarcely considers as equal to the task. As to Lefèvre-Gineau, who was charged with Fortin to determine the kilogramme, he actually pierced with a small hole the hollow cylinder which was to give a determinate number of grammes, "in order that the air in the interior should be in equilibrium with that at the outside!"

It would be evidently impossible to rectify any mistake without causing a most deplorable confusion, particularly in the countries now using the French system; but it must never be forgotten that the kilogramme is only approximatively the weight of a cubic decimetre. All physicists must wish for a new and exact comparison between the metre and the kilogramme; and until that takes place there is no certainty that a given volume of a substance, whose specific weight is known, has a given weight in grammes; and *vice versâ*. It is said that the eminent Laplace was extremely anxious, during the last years of his life, about the probable disagreement between the metre and the kilogramme. M. Babinet also states that he has seen the *procès-verbaux*—sold as waste paper—of the Metric Commission, and there was nothing about them that showed a careful elaboration of the question. According to Mr. T. Q. Adams' Report to Congress on Weights and Measures (Washington, 1821), it would appear that the International Committee adopted as a second natural standard the pendulum vibrating seconds at the 45th degree of latitude. Mons. Babinet seems to be ignorant of this fact; for he insists on the importance of ascertaining the exact deviation of the metre from the meridional standard, in case the standard metre in the Archives should unfortunately happen to be destroyed.

The *soi-disant* practical men, Messrs. Henley and Hubbard, who opposed Mr. Ewart's Bill, did not allude to these objections. It is absurd to say, with the former gentleman, that "though the country was asked to adopt the French system, it was not to take the French measure, but decimal parts of an inch, which were to be compared with the French unit." This assertion only finds its parallel in his statement, that "the world was continually growing," and that the measure of the unit would be thus lost. Mr. Hubbard also was mistaken in his supposition that the introduction of the French metrical system would cause great inconvenience to the working classes. It is within our own knowledge that the metrical system is largely in use in the Lancashire engineering workshops. In the specification of many foreign orders, the dimensions are often marked in metres, and it is thus easier to work with the metre than to translate the dimensions into English measures. Giffard's injectors are made by Sharp, Stewart, and Co. to the metric system of measures, and the workmen adapt themselves with the greatest ease to the metre and its decimal parts. Instead of the vague "one-sixteenth full," or "one-sixteenth bare," too often to be seen written on the full-size drawings of even first-class establishments, a neat decimal figure shows the exact limit required for a true fit. But few good workmen are of the opinion of a certain engineer of our acquaintance, who, on being asked which measure he most referred, replied that he liked best the one used in the States, "because it was the same as the English foot."

Leaving aside the disastrous mistakes made in determining the French standard, the metric system, as compared with our own, is simplicity itself. A French engineer, in working out any measurements, has merely to deal with the metre. Its multiples are designated by simply preferring the specific terms for 10, 100, 1,000, &c., taken from the Greek, whilst the decimal submultiples are shown by similar prefixes taken from the Latin. English en-

gineers have to reckon in inches, feet, yards, fathoms, poles, furlongs, and miles; the respective proportions of which are 12, 3, 2, 2¾, 40, 8! We again find that the mechanical engineer takes the foot, the civil engineer the yard, the mining engineer the fathom. Some mechanical engineers divide the foot decimally, others use barleycorns or twelfths of the inch, while the majority use sixteenths of the inch. Many civil engineers have adopted the acre as a unit, with decimal divisions of that unit. With regard to the fathom, there are three different lengths going under this name, the 6 ft. fathom of a man-of-war, the 5½ ft. fathom of a merchant vessel, and the 5 ft. fathom of a fishing smack. Such partial systems as that of Mr. Whitworth, who takes the foot as a unit; or the proceeding recommended by Mr. J. Simon Holland,* that of having the sixteenth of an inch as a basis, would, in course of time, only make the present confusion worse confused, and leave us in a worse state than we now are. What is wanted is a sound comprehensive measure, of universal application; and the first throes that generally attend the introduction of any novelty, being once overcome, the question will then be settled for ever. While deprecating a servile copying of the French system, or rather of the French standard, we would, nevertheless, urge upon our legislature the speedy adoption of decimal weights, measures, and coinages. Like every innovation it will, doubtless, cause some hardship to individuals—*e.g.*, separate old patterns of machinery could be seldom used in a new arrangement calculated to the metre; many valuable scientific publications would be greatly depreciated by an introduction of a new system of weights and measures; some of the useful formulæ and numbers committed to memory by most engineers would have to be unlearnt. The law would, however, be a national advantage—indeed a universal benefit; for North America and Russia, who now use our foot measure, would then assuredly employ our metre.

STEAM FIRE-ENGINE COMPETITION.

Now that the excitement attending a public competition has settled down into something like calm reflection, we can consider in its proper light the actual bearing of the memorable trial which has taken place—a trial, the importance of which can hardly be over estimated. For more than a century steam machinery has received an attention which nothing else in the department of scientific engineering can parallel. The consideration of every fact, every theory, connected with it, has been so exhaustive, that in England, at least, the assertion that we had nothing more to learn or to teach would seem fraught with truth, yet, after all, such is not the case. The careful observer is well aware that, although steam machinery performs its office passably well on land and ocean, much remains to be accomplished, much to be learned; and the three days' trial of steam fire-engines at Sydenham has added another and most valuable chapter to the records of steam power.

It is, perhaps, scarcely possible to imagine a situation more trying than that to which machinery is exposed at a large fire. Circumstances preclude, to a great extent, anything like system in its management. All its powers are certain to be taxed to the uttermost, without consideration for consequences. Those who ought to be most careful and steady, unavoidably become participators in the overwhelming excitement of the moment; and both the materials and workmanship of a steam fire-engine, are exposed to tests such as few other forms of machinery ever encounter. A competition, such as the last, may not, perhaps, present the same stimulus to exertion as a fire; still it is not too much to say that the engines which passed scatheless through that ordeal, are capable of meeting most of the exigencies to which they may be in future exposed in the fulfilment of their legitimate duties.

Important as the results have been, they yet leave much to be learned. The experiment has been far more a test, to a certain extent, of the "staying" powers of the machines, than of their actual capabilities. It has proved that a particular class of machinery can be worked to the uttermost, for a certain period of time, without breaking down. It has proved the relative merits of a few different machines under certain circumstances; but it has neither been a test of the relative powers of those machines under *all* circumstances; nor of their capabilities for that long sustained exertion, which we have little doubt they will be frequently called on to make. Nevertheless, the competition has been of the utmost value, just as a single torch is in a vast cavern—it enables us to find a path of escape from a thousand difficulties; and the warmest thanks, not only of engineers, but of the whole community, are due to those gentlemen who formed the Committee, and cheerfully contributed both time and money to an undertaking which cannot fail to be productive of the most valuable results.

We trust, however, that the experiments of the week before last, are but the forerunners of a far more extended and valuable competition. As being the first thing, virtually, of its kind, we could pass in silence over those items in which it is found wanting, were it not that they are eminently suggestive. Failures are more instructive than successes; and although we do not for a moment denominate that which is over, by such a phrase, still its defects point out in a most valuable light what ought to be done in future. The actual quantity of water lodged in the proper place may be a measure of the utility of a fire-engine, but only to a very limited extent. Our readers may rest assured that such a test is, as a general rule, far more a measure of the capabilities of the fireman, of the qualities of hose or jet pipes, and the state of the weather, than it is of the powers of an engine. The trial, by delivering into hoods placed at a considerable height, is so valuable, that it should be on no account omitted; but various other tests should at future trials receive a greater prominence than they have hitherto done. We desire to see steam fire-engines tested for many hours together, not for many minutes; the quantities of water passed through them accurately measured, as well as that delivered at 20 or 30 yards from the delivery nozzle; the actual amount of useful effect, compared carefully with the entire developed power of the machine, not because the consumption of fuel is a matter of any importance, but because the wear-and-tear of necessarily light machinery is, and we may rest assured that every pound of coal consumed unnecessarily is a source of destruction, which should be, as far as possible, obviated by better arrangements. The quantity of water evaporated to perform a certain amount of work is a question of considerable importance. The difference in construction and speeds of the different pumps, and the quantity passed through them, is deserving of attention and comment. Competitions of the kind are not merely intended to bear a passing interest, and afford a momentary stimulus to exertion; their principal value must reside in the instruction to be derived from them as to the relative working, not only of different machines, but of every separate part of each machine. It is of little importance that steam performs its duty well, if the pumps are found wanting, and *vice versa*. The necessary data no trial which has yet taken place can supply, and therefore we trust that no great space of time will elapse until another and far more valuable competition takes place.

Any future improvements must find their development in design. We do not imagine that workmanship can do more. As a general rule, that displayed by the exhibited engines was first-rate, and could not be excelled in the first factories of the kingdom. It has been lately the custom, amongst a certain class, to deprecate the advantages of finish; but we unhesitatingly assert that to it may we trace all that marvellous perfection which causes our machinery to rank so highly in the estimation of the world. We believe that to it, can alone be attributed the endurance displayed by the competing engines during a trial which tested machinery as we never saw it tested before. We would hint to our own engineers that they have something yet to learn from their American brethren, whose brass and copper work is marvellous in its beauty and finish.

At the past trial, a certain amount of confusion was manifest. Perhaps, under all the circumstances, it was unavoidable. We suggest that, in future, not more than one or two engines be tested at a time. The amount of continuous work done in various ways during twelve hours, would afford experience of the most valuable kind; and although it may occupy more time, we doubt if it would, after all, give more trouble to a committee than the present system of trying all the engines of a class at once. A trial has been carefully conducted at Manchester within the last few days, a notice of which will be found elsewhere in our columns. It will be evident from its perusal that the quantity of water delivered into a hood is no accurate measure whatever of the powers of either engine or pump; and until a trial is conducted on somewhat similar principles, we must be content to remain in ignorance as to a thousand little matters of the greatest importance. One important and undecided question we will point out:—We possess no data whatever to show what engine filled its pumps and what engine did not, since the quantity of water passed through them was not measured; yet the pumps were of every variety and worked at every speed. We have no fault to find with what has been done; the results obtained are extremely valuable; all we require is their extension in future.

Our advertising columns prove that American engineers are determined not to permit matters to remain as they are, and we trust that English engineers will not permit the challenge to pass wholly unnoticed.

ROYAL AGRICULTURAL SOCIETY.

(From our Special Correspondent.)

THE MEETING AT WORCESTER.

THE fair and ancient city of Worcester—the scene in days of yore of many stirring episodes in our history—is at present enlivened by the great meeting between agriculturists and engineers perennially held under the auspices of the Royal Agricultural Society. Worcester appears to be one of the pleasantest places in England; handsomely built and well paved and lighted, with very regular and fine streets, the city itself is surrounded by a singularly beautiful neighbourhood, delightfully diversified with richly-wooded

* Vide MECHANICS' MAGAZINE, Vol. LXV., pp. 392, 415, 461, 564; and Vol. LXVII., pp. 176, 444, 495.

hills and dales. "The faithful city," as it is popularly called; from its motto, "*civitas in bello et in pace fidelis*," granted by that merry but somewhat improper monarch—Charles II.—is still constant to its old reputation for pleasantness; even when, as now, the theatre of a peaceful but bustling warfare between rival agricultural engineers. The scene of Cromwell's "crowning mercy"—as he called the battle of Worcester—no longer resounds to the din of a destructive intestine warfare; and *his* stern "Ironsides" are now superseded by iron embodiments of a very different description.

From its central situation, this handsome city is very well chosen for the purposes of the meeting; a slight drawback is perhaps its proximity to the town of Warwick, where the Royal Agricultural show took place such a short time ago as the year 1859.

The show-ground is about forty-one acres in extent—thirty-one acres of which belong to Battenhall Farm, while the remainder is in the occupation of Mr. Peter Foxwell. Besides the show-ground there are different other pieces of land for the trials. These consist of ten acres of grass, thirteen acres of land, besides two other pieces of fifty acres each. All these lands are of various qualities to meet the different kinds of trials of implements. All the works on the show-ground, have been entrusted to the gentleman who acted as contractor in a similar capacity at Battersea, last year. The directors of the West Midland Railway have carried out a branch line to Battenhall, for the convenience of the show, which is, however, not much farther than a mile from the centre of the city. The ground is very uneven and hilly, but what it loses in this respect it regains in the picturesque. The number of the implements exhibited (5,375) and of the exhibitors' stands (330) is rather high, although two of the larger makers are absent—the two Suffolk firms of Messrs. Ransomes and Sims of Ipswich, and Garret and Son of Leiston. The attractions of the Agricultural Show just now being held in Hamburg are probably too strong for those firms.

The weather on Wednesday was splendid, and a light breeze relieved the heat of the sun. The Agricultural Derby seems likely to be more fortunate this year, as regards weather, than its prototype of the turf, the London Derby, that great day for Cockneys. On entering, we perceived one of the steam horses, then being strenuously plied with coal and oil in its race for the prize "for the lowest consumption of fuel"—the "blue riband" of agricultural engineering. It was a fixed engine belonging to Messrs. Clayton and Shuttleworth, of Lincoln; the priority of its trial was due to that firm's name having been first drawn forth in a trial by lot. The somewhat delusive and uncertain nature of the trial of a *stationary* engine on the open field, was evidenced in the rocking motion the whole structure was undergoing from the absence of a foundation, with proper attachments. Great experimental investigations have shown long ago that a considerable amount of power is lost when an engine or machine is subjected to vibration.

The trials are conducted upon exactly the same system as at Chester in 1858, the last time that portable and fixed steam-engines were tried by the Royal Agricultural Society. Five years' reflection might have improved plans that are open to many and varied objections.

The usual quadrennial course of trials was broken into last year at Battersea, as neither engines nor implements were put to competition. Steam ploughs have been latterly tried every year; being treated as a new implement apart from the usual classification; and a special prize has been annually awarded to this kind of implement since its first appearance at the shows—the Battersea year excepted. These are the most interesting trials, from their comparatively novel character, and we hope to give a full account of them next week. No less than eleven different firms exhibit in this line—viz., Messrs. Smith (Woolston), Turner, Beards, Howard, Savory, Hayes, Fisken, Coleman, Fowler, Steevens, and lastly Mr. Williams.

In the course of our necessarily cursory and hasty examination, we could not perceive any implement of a very novel character. Perhaps, the most original stand is that of A. B. Childs, and in particular the exhibit No. 5,782, a chaff-cutting machine, invented by Messrs. Gittus and Leggett, of Mildenhall, Suffolk. The knives are moveable, and they are driven by an eccentric fixed to the fly-wheel, being arranged in such wise as to give a drawing cut just like the old hand-knife. One new thing—if we may so term it, for it is rather the application of a novelty, than a novelty itself—is the greatly-spread adaptation of Bruckshaw and Underhill's elevator to thrashers; an improvement effecting a great simplification of these still much-to-be-simplified machines. We gave a description of this grain-elevator in our number for the 12th of June (p. 424). Its general principle may be said to simply consist in the grain being brought into immediate contact with the blades of a common fan; the grain is thus cleaned and elevated by the conjoint action of the percussion, centrifugal force, and the blast, generated by the revolution of the blades. The bringing forward of this valuable arrangement, has directly and indirectly effected quite a revolution in thrashing machines; and we have probably not yet seen the last and most forward shape in which this improvement may be carried out. It is, perhaps, not generally known that this adaptation of the common fan has been proposed nearly a century and a half ago, and has been in extensive use for many years by our ingenious neighbours across the channel. The principle of Bruckshaw's elevator, will be found described in a work in the British Museum of so old a date as 1716. In the third volume of that well-known and famous work, the "Machines Approuvées par l'Academie des Sciences," p. 101 to 103, will be found the following remarks, at the end of a description of an ordinary fanning machine:—"Le Baron de Knopperf indique, tout d'abord l'usage qu'on pourrait faire de ce même ventilateur comme d'un veritable tarure, propre à battre le blé tombant d'une tremie sur ses planchettes, d'on il serait *lance et chape* à des distances diverses correspondant à autant de cases separées," &c. This idea was fully carried out more than twenty years ago by Zerôme Brothers, of Amiens (Somme), in France, who, we believe, actually exhibited "a machine for winnowing buckwheat," embodying this principle, in the Great Exhibition of 1851, as appears by the Official Catalogue, vol. III, p. 1,204. These French machine-makers have taken several patents for winnowers embodying the principle of elevating grains by the direct use of a fan. *Vide* "Description des Machines et Procédés pour lesquels des Brevets d'Invention ont été pris, &c. Publiée par les orders de M. le Ministre de l'Agriculture du Commerce, et des Œuvrages Publics." These machines are fully illustrated and described in vol. viii., p. 135, plate 17; vol. xxiii., p. 25, plate 7; vol xxix. p. 106 to 109, plate 21, &c. A description and illustration of Zerôme's winnower will also be found in the first volume of "Génie Industriel" of Armangand, a work which was by-the-bye, exhibited in the Great Exhibition of 1851. There is little doubt that Mr. Bruckshaw invented his elevator independently of his French forerunner; but what becomes of his patent right under such circumstances? These works have been before the English public, in the Patent-office library and in the British Museum long anterior to the date—1858 we believe—of his patent.

MAGNETO-ELECTRIC MACHINES.

One of the principal obstacles encountered in the practical application of electricity as a motive power, is found in the small amplitude of the elementary movements of electro-magnets, since their powers of attraction do not commence till they are almost in contact—the limit of distance varying from 1 to 2 millimetres at most.

Thus, all inventors who have proposed their use as a means of producing motive power, have sought to overcome the difficulty by causing the attraction to exert its powers at an angle, or by following the surface of a cone so as to augment the amplitude of the movements, with, however, a proportionate decrease of power. We now propose the adoption of a new combination to be called *contracteur electrique*, which shall imitate the play of the muscles in the organized body, and which will permit the transformation of the trifling direct motion of a series of electro-magnets, into a movement, ten, twenty, or a hundred times as great.

If we take discs of soft iron, and convert them into very deeply-grooved pulleys, in order that they may receive some thousands of turns of insulated copper wire, we can thus transform them into magnets by the passage of an electric current through the wire. If we superimpose a number of these discs, separated by small rings of india rubber, one millimetre thick, on the passage of a current, all the discs will approach each other, compressing the india rubber; and thus the pile of discs, if composed of 200 elements, for example, will shorten or contract on itself one decimetre, although each disc moves through but one half millimetre.

This is the first idea of contractors or electric muscles.

It is easy to understand that by fitting one end of such a pile to the connecting rod and crank of a fly-wheel, and the other extremity to a fixed support; we can obtain as great a number of revolutions as we desire, with a force depending on the power of the pile. By combining this idea with that of tubular electrical piles producing electricity in quantity, shall we not find the solution of the problem of applying electricity to the economical production of motive power?—*Portefeuille Economique de Machines.*

BOILER RIVETING IN THE UNITED STATES.

(From "Practical Notes on Steam," by W. H. King, U.S.N.)

In the United States there are three mechanical modes of uniting plates together; namely, *machine-riveting*, and *hot* and *cold hand-riveting*. On the seaboard, all kinds of boilers are riveted by the two first-named methods, in both of which the rivets are put in hot. West of the Alleghanies, all riveting is done by hand, and at Pittsburgh, Louisville, and other places, the rivets are driven cold in all places accessible for the purpose.

For the cold process, a superiority is clamed consequent upon the holes being well filled with the body of the rivets; that is, there can be no contraction—hence reduction in the strength and in the rivets' diameters after the workmen cease hammering on the heads. The reverse must be the case when driven hot; for, in cooling, the diameters are reduced by contraction. Moreover, none but the best quality of iron can be used in rivets driven cold; because, if the iron be inferior, it is sure to crack or split through the head, each one being tested by the heading.

For hot riveting, it is claimed that, in cooling, the rivets contract in length, drawing the sheets more closely together, thereby creating adhesion sufficient to add to the strength of the joint.

Mr. Clarke, resident engineer of the Britannia-bridge, made some experiments to determine the value of this. Three plates were riveted together by a machine, maintaining a temperature of 900 deg. in the rivets; each outside plate had a circular hole in which the rivets fitted exactly; but in the centre one the hole was oval, or 2¼ in. long for a ⅞ rivet, and the rivet was not allowed to touch either end of this hole. A strain was then put on the centre plate till it began to slide, which it did abruptly. Several trials were made, and the least result was an adhesion equal to 4½ tons with ⅞ rivets. Mr. Clarke infers from this experiment that, by judicious riveting, the adhesion may in many cases be nearly sufficient to counterbalance the weakening of the plates from punching the holes. In this particular we regard his opinion as an error; for if he had continued the strain on the plate until it parted, or the rivets broke, he would doubtless have found that the total pressure, or breaking strain, would have been 56 per cent. if single-riveted, and 75 per cent. if double-riveted, of the sheet, as fully tested by other experiments. Theoretically, there is a gain from adhesion in hot-riveted joints, but practically this seems to be lost by the contraction of the rivets' diameter, thus making the total or breaking pressure the same.

In western river boilers, where the pressure of steam used is higher than in any part of the world, no difficulty has ever been experienced from the cold-riveted joints not being closely united and perfected tight; and as regards strength compared with the hot-riveted, superiority is claimed by those having cold-riveted boilers in charge.

In either mode of hand-riveting the rivets can be seriously injured by too much hammering, and in any case by overheating. Due regard should be had to the temperature, and the blows of the hammer should be hard and quick, and not continued longer than necessary to form the head. Machine riveting has the advantage of forming the head at a single blow, and the rapidity with which the work can be performed must always give it preference over all other methods where it can be employed.

It is to be regretted that no extended set of experiments have ever been made in this country to determine the relative strengths of the different modes of riveting and uniting the sheets of steam boilers and other iron structures; also to test the relative value of the materials used in this country at the present day; for it must be evident that although the results of European experimenters on iron and steel are of value to us, yet they cannot be regarded as entirely applicable to American constructions, because our iron ores, the temperature of blast of smelting furnaces, and manner of working the metal through the different processes, and the fuel used, all differ in a large degree from those abroad.

SHOEMAKING BY MACHINERY.

THE employment of machinery in the manufacture of boots and shoes is of but recent date, but it has effected a wonderful revolution in this important industrial art. On this subject the Lynn (Mass.) *Reporter* says:—

Comparatively few people are aware of the quiet but steady revolution that is going on in the buisness of shoemaking, and particular as that buisness is conducted in Lynn. Previous to the introduction of the original sewing machines, which are now universally used for the binding and stitching of the uppers, but little or no improvement or even change had been made in the manufacture of shoes. The awl, the bristle, and thread, the lapstone and hammer, with plenty of "elbow-grease," were, as they had been for years, the main appliance of the shoemakers, and little was known or thought of labour-saving machinery. After a time women's nimble fingers were found inadequate to the demand, and sewing machines soon transformed the old-fashioned "shoe-binders" into a new and more expansive class of "machine girls" whose capacity for labour was only limited by the capabilities of the machines over which they presided. Iron and steel came to the aid of wearied fingers and weakened eyes. This was the beginning of the new era, which is destined to produce results big with lasting benefit to our flourishing city.

It is scarcely ten years since the first introduction of machinery of any kind into the manufacture of shoes in this city. Everything was done by hand, even to the cutting out of the soles, which was a slow process and required the expenditure of a large amount of physical force. The introduction of sole-cutting and stripping machines, although sparingly, was the first indication that a change was to take place in the buisness of shoemaking; but no one, even ten years ago, would dare to have prophesied that the change was to be so immediate and so great. The rapid progress that has been made during that time, and especially within the last year or two, in the introduction of machinery in shoemaking has been beyond all previous calculation. It may almost be said that hand-work has already become the exception, and machinery the rule. The little shoemaker's shop and the shoemaker's bench are passing rapidly away, soon to be known among us no more; and the immense factory, with its labouring steam-engine and its busy hum of whirling wheels, is rising up in their place, to change the whole face of things in this ancient and honoured metropolis of the "workers in the gentle craft of leather."

The problem as to how best to bring in and concentrate the vast army of men and women employed in the shoe manufacture of Lynn is one that has attracted the attention of many thinking minds among our business men, but it has never been satisfactorily solved until now. Machinery, and particularly the sewing machine, has done in a few short months what years of theorizing and speculation could not do. It has demonstrated that the factory system can be successfully and profitably introduced into the shoe business; in fact, that, with the rapid strides which the business has made within a few years, it is the only system that can be made available for its successful application in future. Of course, the new system is yet in its infancy—the business is yet in a transition state; but the wheels of revolution are moving rapidly, and they never move backward. Operatives are pouring in as fast as room can be made for them; buildings for "shoe factories" are going up in every direction; the hum of machinery is heard on every hand; old things are passing away, and all things are becoming new. Could the disembodied spirits of some of our old-time inhabitants visit the scenes of earth once more, how great would be their astonishment at the change which has taken and is taking place in this once quiet town which claimed them as citizens!

THE ASTRONOMER ROYAL'S REPORT.

THE Astronomer Royal has sent us a copy of his report to the Board of Visitors, dated June 6th, 1863. Among the results of the past year's labour at the Observatory we read:—

"The meridional observations of Mars, in the autumn of 1862, have been compared with those made at the Observatory of Williamstown near Melbourne, Australia, and they give for mean solar parallax, the value 8·932 sec., exceeding the received value by about 1-24th part."

"The mean magnetic declination for 1862 is about 22 deg. 52 min.; the diminution in the year appears to be 13 min. The mean dip for 1862 is about 68 deg. 11 min.; at the present time it appears to be 68 deg. 4 min."

Considerable labour has been given to a numerical discussion of the Magnetic Storms, from 1841 to 1857. The reductions are not quite finished; but they have suggested to Professor Airy the idea, apparently confirmed by a separate deduction from the magnetic phenomena attending the splendid aurora seen December 14th, 1862, that, "the action of the earth-currents upon the magnet is in the same direction in which the earth-current flows, and not transverse to the current direction as is usual with galvanic currents." This result is certainly very remarkable. The Astronomer Royal adds:—"If this should be confirmed, then, viewing the rarity of disturbances in the vertical direction as produced by magnetic storms, and their great violence when they do occur in the vertical direction, I shall have no hesitation in suggesting, as a general theory of magnetic storms, that the idea of attraction is to be abandoned, and that they are to be referred to currents of a magnetic ether whose movements are closely analagous to that of air, the vertical movement of which occurs but in few places, but in these places is excessively violent. Much, however, must be done before such a theory can be established."

As regards chronometers and the communication of time, this is what the report states:—

"The number of chronometers on hand at this time is 132; of these, 82 are compared with a standard clock every day, and the others are compared on one day in every week. The standard clock is one of a series of galvanic clocks whose movements are necessarily synchronous with that of the motor clock; which is accurately adjusted to mean solar time by means of a galvanic action upon its pendulum, that can be used for any arbitrary length of time to accelerate or retard the clock by slow degrees during that time. Every chronometer, whatever be the reason of its lodgment at the Royal Observatory, is tried during some part of its stay in the heated chronometer oven.

"When it is necessary to decide on the merits of chronometers, either as affecting their price for purchase, or as deciding their place in the published order of merit, the decision is made by me. The repairs of chronometers the property of the Government are entirely managed by me.

"The drop of the time-signal-ball at Deal, by a galvanic current from this Observatory, which is automatically given by the corrected motor clock, is perfectly efficient, no failures occurring except from the defects of adjustment of the clock at the London-bridge station which changes the connections of wires. Time-signals are sent daily along the principal lines of railways, the most distant points (I believe) being Glasgow and Cardiff. I have also heard that the companies, through whose offices the wires pass, have begun to distribute branch signals to private factories.

"The clocks of the General Post Office are connected as formerly with the Observatory, each of four clocks being adjusted by current from our motor clock once every day, and reporting itself to us twice every day. The clock of Westminster Palace has also been brought into connection, the attendant receiving a signal from us once every hour, and the clock reporting its state to us twice every day. As far as I have yet observed, the rate of this clock may be considered certain to much less than one second per week."

Legal Intelligence.

SOUTHWOOD V. FAIRBAIRN.

THE question involved in this trial, which took place at Oxford, before Mr. Baron Martin, is one of some interest to engineers. Mr. Serjeant Pigott and Mr. Gray were for the plaintiff; Mr. Davis for the defendant.

The plaintiff is an engineer now living at Birmingham, but has spent many years in the Australian diggings. On his return home he took out a patent for crushing quartz and all descriptions of ore and stones, not only for extracting gold, but for the purpose of metalling roads. In November he entered into a contract with the defendant, an engineer in Southwark, to make and erect on the defendant's premises, and work with 10 or 12-horse power, and make ready for experiments, one of those machines within two months for £95, £40 to be paid during or on the completion of the machine. A dispute subsequently arose, and the defendant refused to complete the contract, although the plaintiff had paid him £20 on account. This refusal the defendant did not now attempt to justify, and paid £40 into court; therefore, the only question was the amount of damages to which the plaintiff was entitled. The plaintiff claimed as damages his inability to exhibit the machine or to execute various contingent orders which would each have realized a profit, or to carry out arrangements he had made for going out to Australia to push the patent under the auspices of a company. The defendant contended that such damages were rather conjectural than substantial.

The learned Baron said the difficulty was to lay any fixed rule as to what were direct and proximate damages, and that it was one of those matters which lawyers, when puzzled, put upon the jury, but that annoyance or vexation arising from unpunctuality was not a subject for damage.

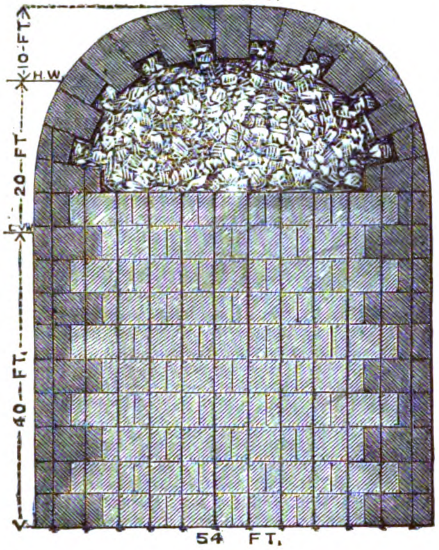
The jury found a verdict for £30 more than the sum paid into court.

IMPROVEMENTS IN THE CONSTRUCTION OF HARBOURS, BREAKWATERS, PIERS, JETTIES, SEA AND RIVER WALLS, &c.

By Alexander Doull, C.E.

Fig. 1 is the section of a breakwater with vertical walls constructed in 10 fathoms water, 40 ft. below low water, and 20 ft. between high and low water, and 10 ft. above high water, making 70 ft. as the whole height of the structure.

FIG. I.



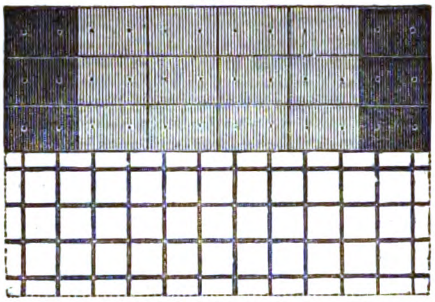
The section is 54 ft. wide at the base, and is carried up perpendicularly to about 10 ft. above low water line, and is then finished by a flat curve. It is considered that the curved form given to the top of the work will secure the stones more firmly in their positions, and will allow the top of the wave to pass over the wall and fall into the harbour without propagating a wave or causing an inconvenient disturbance of the water in the harbour, and also with the least possible injury to the wall. In this section the work is composed of stone blocks, averaging 9 ft. long, 4½ ft. broad, and 4½ ft. thick, weighing about 11 tons each. These stone blocks are placed headers and stretchers in the outside of the work, the inside being filled up by concrete blocks of the same dimensions. The dimensions of the blocks, both of stone and concrete, would, however, be occasionally varied in length and thickness, in order the more effectually to break bond horizontally and vertically. The concrete blocks in the interior of the work would be continued up to the low water line, after which the centre of the work would be composed of concrete in mass, and the outside and top of stone block, which may be cramped together in any convenient manner.

The blocks of stone and concrete are placed in position up to the low water line by guide rods of malleable iron, about 3 in. in diameter, two rods passing through each block. The holes in the blocks of stone would probably be more economically and accurately bored by machinery; the holes in the concrete blocks would be moulded in them at the time of their formation, and would consequently cause no additional expense.

During the process of construction, the rods would be carried up to the staging, and the upper ends of them secured in such a manner that any two of them could be disengaged and inserted into the hole of the block previously to its being lowered into its position from the staging.

In order to place the rods at the proper distance from each other, and to retain them in that position, agreeing accurately with the holes in the several blocks, the grating, fig. 2, is made use of. It is composed of flat bars of malleable iron, about 6 in. broad and half an inch thick, riveted or welded together, and holes bored at the intersections of the bars accurately corresponding to the holes in the block. This grating would be formed in convenient lengths.

FIG. 2.



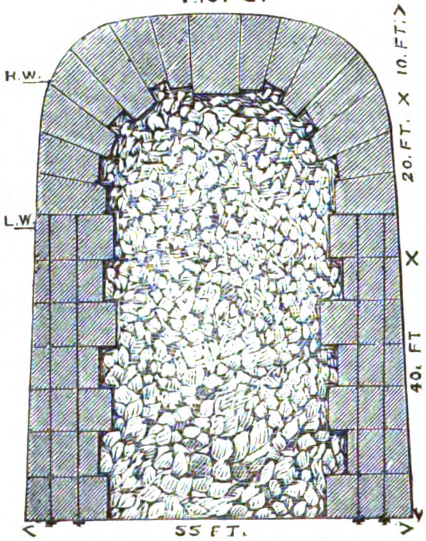
The rods having been screwed together and the upper ends attached to the platform as near their proper positions as possible, and their lower ends resting on the ground, the grating is passed over the ends of the rods and allowed to drop down along the rods to the ground, and to rest upon the heads of the rods, and thus form an efficient gauge to preserve the rods in their proper relative positions ready for the deposit of the stone and concrete blocks. In connecting one length of the grating with a previous one in the onward progress of the work, the advanced row of rods must be left clear of blocks, in order that the set of holes in the next portion of grating shall pass over the rods in the advanced holes of the previous grating. It will thus be observed that two sets of holes will pass over one set of rods at the junction of every successive portion of the grating.

This mode of construction would be well suited for such works as those which are at present being carried on in connection with the proposed Harbour of Refuge at Dover, and which is said to cost about £1,100 or £1,200 per yard forward. The slow progress of the works, consequent upon diving-bell operations, is so great, and the expense of construction so excessive, that no reasonable hope can be entertained of ever obtaining a Harbour of Refuge at Dover by the means at present in operation.

The only alteration necessary to be made from the above in the construction of *circular pierheads*, would be to form the iron grating used for the proper adjustment of the guide rods in a circular or any other required form, and to prepare the holes in the stone or concrete blocks to correspond to the position of the rods. This, it is presumed, would be an expeditious and cheap mode of constructing pier-heads in connection with breakwaters where the whole of the materials had been thrown into the sea from tramways, but where the pier-heads are, as at present, constructed by the aid of the diving-bell.

The following (fig. 3) is a still cheaper mode of constructing a harbour of refuge than that already described:—

FIG. 3.



The outside courses are constructed of blocks of concrete, faced on the ends and sides, which are exposed to the wash of the water with hard blue bricks, manufactured expressly in such a manner as to unite more effectually with the concrete. These brick facings would be carefully built in cement in the end or side of the mould in which the concrete block is formed. The brick-work would be competed, and the concrete poured in afterwards; or the two materials could be applied simultaneously. Holes for the guide rods would be preserved in the blocks when they are being moulded.

Blocks of a large size may also be used, probably from 40 to 50 tons weight; and by substituting cast for malleable iron in guide rods, it being more durable than malleable iron in sea water, considerable stability would be derived from the guide rods, as they could be screwed into proper guage by the grating already described.

The centre of a construction of this description may be composed of rubble stone, brought up in layers corresponding with the outside block courses. On the top of each layer of stone, liquid concrete would be put down in boxes or leather tubes, sufficient to fill up the interstices of the stone rubble.

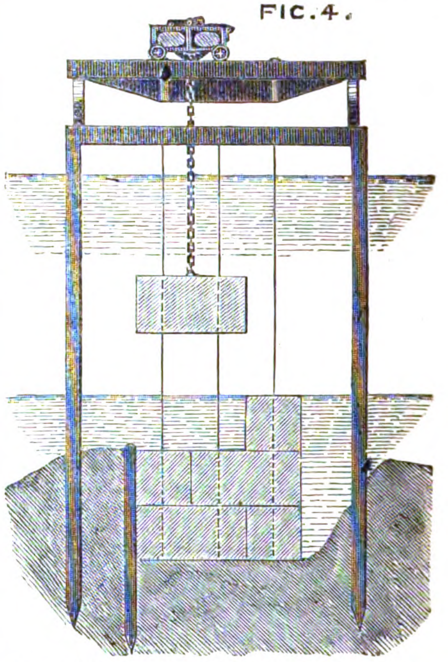
In some situations the chalk could be employed for the purpose of filling. The only essential condition in this case would be, that no water should be allowed to pass in through the exterior block casing to wash away the chalk. The economy would also be very great where hard block chalk in abundance can be found upon the spot.

The expense of a structure of this description would probably be about £150 per yard forward, or about two miles of wall for little more than half a million of money.

In constructing a breakwater (such, for example, as in the bay of Wick), where the stone to be used is of the nature of slate, or large slabs comparatively thin: in this case it is essential that the stone should be placed vertically in the outside of the work; for, if large flat stones are thrown into the sea from a staging, they would spread out to a very inconvenient extent.

For the purpose of placing the stones composing the outsides of the work in a vertical position, or nearly so, a frame (somewhat similar to those used in hoisting materials to buildings) would be used, extending from the staging to the

FIG. 4.



bottom of the sea, and capable of being raised or lowered according to the irregularities of the bottom. To this frame a slide would be attached, upon which the stone would be placed, and, when lowered into its position, the slide would be also

arranged that a portion of it would be acted upon from the platform so as to cast the stone forward into its place. The weight of the stone about to be placed would press out the lower end of the vertical frame sufficiently far from the finished work to admit the deposit of stones successively sent down in the progress of the work. A diver could be occasionally sent down to examine the progress of the work.

Fig. 4 is a cross section of a river wall, about 12 ft. or 15 ft. below low water, and in about 10 ft. of excavated mud or gravel. Staging is erected over the length of the portion of wall in progress, and the excavation is effected to the necessary depth by a vertical dredger, attached to a traveller in such a manner as to be readily placed over every portion of space to be operated upon. This dredger or excavator would be lowered as the work progressed, and by this means the bottom of the excavated portion would be formed perfectly level, ready to receive the concrete blocks. The concrete blocks would be formed of any convenient size, and each block would have two holes in it, for the purpose of being placed in position, as above described with reference to breakwaters.

Cast-iron sheet piling would be driven on the river side to protect the concrete blocks from the action of the current, and also to guard against injury to the foundation by the scouring out of the bed of the river when its breadth has been contracted.

This sheet piling on the river side, and temporary sheet piling on the land side, would be necessary to preserve the proper form of the excavation until the concrete blocks have been deposited.

This mode of putting in the foundation of river walls, it is presumed, is peculiarly applicable to the embankment of the north and south sides of the Thames, about to be undertaken by the Board of Works—more efficient and more economical than by sinking cylinders by divers.

TRIAL TRIP OF THE TWIN-SCREW STEAMER "DIANA."

THE trial trip of this vessel took place on the 30th of June last, and the results have been pronounced very successful. The following are the most important particulars:—

	h. m. s.		m. s.
No. 1. Full speed ahead	2 36 20		
Stopped	0 37 34	...diff.	1 14
114 revolutions way astern	0 39 10	... „	1 36
„ „ full speed	0 39 40	... „	0 30
Evolutions completed in ...	0 3 20		

No. 2. Full speed ahead,

	h. m. s.	m. s.	
helm hard a starboard	2 44 30		
120 revolutions ...	0 48 40	4 20	... 1st circle.
	0 58 18	4 18	... 2d „
	0 57 2	3 44	... 3d „

mean of three = 4 7·33

Diameter of circle described 3½ times length of vessel.

No. 3. One engine full speed ahead, helm hard a starboard—

	m. s.	h. m. s.	
half circle...	1 24 }	3 9 20	= 3 50...1st circle.
completed...	1 26 }	0 13 10	
half circle...	2 0		= 4 16...2d „
completed...	2 16	0 17 26	

The way being deadened and wind on the bow caused slight retardation.

No. 4. Engines working in opposition, starboard ahead, port astern—

h. m. s.	m. s.		m. s.
3 20 12			
0 23 48	3 36		
0 29 7	5 19	...... mean	4 27 5

To test the power of turning to avoid danger or pick up a man. Full speed ahead; helm suddenly put a starboard, port engine reversed—

	m. s.
half turn..................	1 25

The manœuvre of steering by the screws in going stern foremost, was then put under severe trial and performed admirably, but the greater depth of the keel and after body demanded very accurate seamanship. We trust soon to learn that Government will adopt more decisive measures for the introduction of this important aid to manœuvring ships-of-war.

NEW RAILWAY SYSTEM.

AN inquiry is open at the present moment in the departments of the Seine and Seine-et-Oise relative to a proposed railway which is to be laid down in a direct line, traversing all the inequalities of the surface of the country, from Paris to Marly-le-Roi. The concession for the proposed line has been made to M. le Baron Séquier, represented by M. Duméril, C.E., and is the result of demonstrations made at the Palace of the Tuileries of the advantages of a system laid before the Academy of Sciences on the 18th of December, 1843, by M. le Baron Séquier. The principle of this system is, shortly, the same as that which we have described, illustrated, and discussed in a memoir on railway in general, and on Jouffroy's system in particular. M. Séquier thus explains an invention which has remained for twenty years as a little model:—"We supply the cause of movement to locomotives by the pressure by springs of their wheels against rails and not in the simple adherence of the wheels to the rails by the weight alone of the machine.

"An ordinary railway, with simply a third rail of wood or iron laid down between the other two; locomotives nearly the same as those we have at present, only their driving wheels changing their places, and our problem is solved. Let us explain:—We propose that the two driving wheels, placed horizontally and acted on by very powerful springs, shall grasp the central rail—firmly fixed to the sleepers—between them, as a train of rolls does a bar of iron. The adhesion of the wheels then due to the pressure of the springs secures the fulcrum necessary for the propulsion of the engine and train.

"The power of the springs, then, which force the wheels horizontally against the rails, becomes the measure of the capabilities of the machine, instead of its weight. All attempts at producing a light locomotive have hitherto failed, because weight is necessary to adhesion. Here we see this difficulty at once overcome.

"A simple enlargement of the central rail, acted on, on inclines by smaller wheels on the same axle, suffice to augment the power of the locomotive. Thus, in a moment speed can be converted into tractive power or the reverse."

We earnestly hope that the labours of MM. Séquier and Duméril may be crowned with success.—*Les Mondes.*

ROYAL SCOTTISH SOCIETY OF ARTS.

ON Monday night, a meeting of this Society was held in their hall, 117, George-street, Edinburgh—Dr. Stevenson Macadam, President of the Society, in the chair.

The secretary (Mr. Beatson Bell) read the following reports by committees appointed to consider various communications made to the Society during the past session, which were approved of:—

The committee on Mr. T. Whimster's improvement in the working of hydraulic mains, reported that they were of opinion that the thanks of the Society were due to Mr. Whimster for bringing the subject of his paper before the Society, as, although the plan had been previously adopted, it is not generally known, and may be advantageously adopted in other gasworks.

The committee on Mr. Whimster's description of a self-regulating valve or compensator for gaswork exhausters, reported that the invention of Mr. Whimster showed a considerable amount of ingenuity, and would answer the purpose for which it was intended, but that it wanted the simplicity of several plans now in use for the same purpose, which were found to work without creating any inconvenience.

The committee on Mr. J. Laird's horizontal windmill, reported that the invention was not new, but that the same object was attained several years ago by Mr. George Buchanan.

The committee on Mr. Henry Kerr's new gravity escapements, reported that in all his inventions Mr. Kerr had displayed very great ingenuity; but that in them all there was a complication in the working parts which would render their construction very difficult, and might give rise to many sources of error when brought into action. The committee were therefore of opinion that though Mr. Kerr may have obviated some of the defects acknowledged in all gravity escapements hitherto invented, it was doubtful if his inventions, if carried out into practice, would be found to be real improvements.

The committee on Mr. Sang's communication on the sefinet equation for determining the form of a ship's hull, reported that Mr. Sang's communications on ship-building were worthy of the highest commendation.

The committee on Mr. William Paterson's improved signal, and method of working single lines of railway without risk of accident, reported that they were of opinion that the way of working "by a train staff" was equally safe with that proposed by Mr. Paterson, the handle required for opening the main signal being practically a train staff.

The committee on Mr. Robert Gray's apparatus for impregnating gases with the vapour of volatile hydro-carbon fluids, reported that they were of opinion that Mr. Gray's apparatus was by no means new, as similar arrangements for promoting the absorption of a liquid by a gas, and the converse, had been in use prior even to the date of Mr. John Reid's specification of patent for apparatus for saturating gas with water vapour. The committee were of opinion that Mr. Gray's apparatus was not more effectual for the purpose of bringing the gas into contact with the liquid, than Mr. Reid's arrangement.

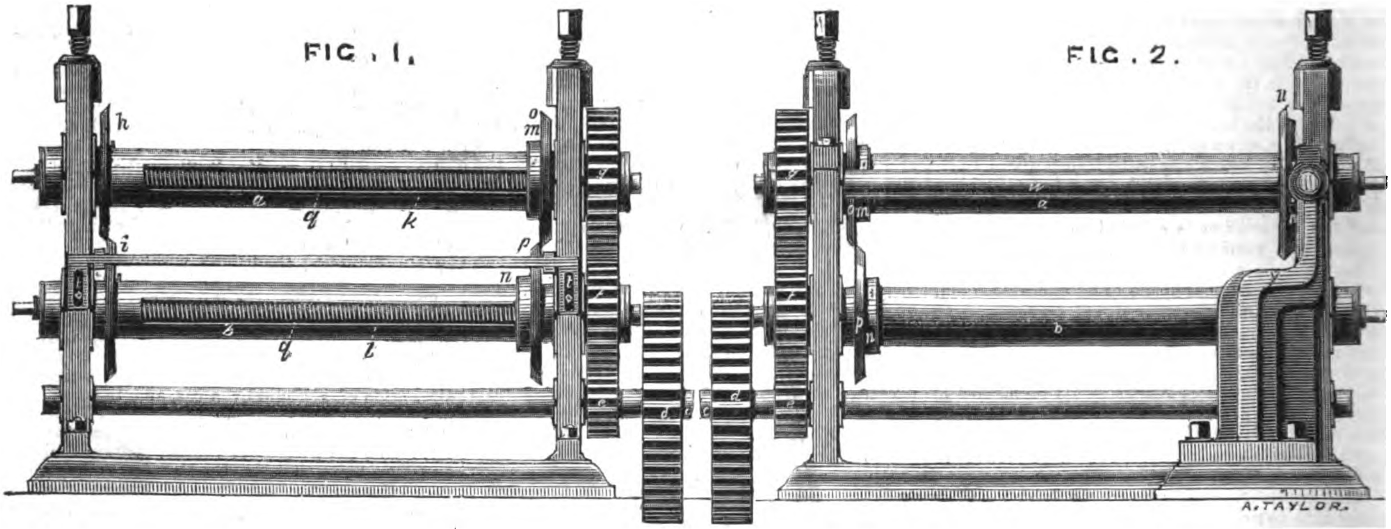
The committee on Mr. Joseph Polson's machine for blacking boots and shoes, reported that the machine was an improvement over the common method with hand brushes, and might be found useful where there was constantly a large number of shoes to be cleaned. At the same time, the committee did not think that the reciprocating brushes, which appeared to form the principal novelty in the arrangement, were so good as the rotary ones, as used by Mr. Polson for the first part of the operation, but which were used and found by other makers to be all that could be desired for the whole process.

The committee on the Rev. James W. Miller's communication "on the Effective Power transmitted from the piston-rod to the crank of the steam-engine, &c.," reported that they regretted they could not recommend Mr. Miller's communication to the favourable notice of the society.

TRIAL OF ENGINES FOR THE MANCHESTER FIRE BRIGADE.

THE re-organization of the Manchester Fire Brigade has led the Watch Committee to decide upon replacing several of their old engines with new ones. With a view to ascertain the merits of two engines that had been specially recommendad to them—one constructed by Messrs. Shand and Mason, of London, and the other by Mr. W. Rose, of Manchester—they were tried a few days ago in the police-yard. The points to which the Committee directed their attention were the weight of the engine, the quantity of water projected at certain heights and distances, general workmanship, and price. The testing apparatus consisted of a hood or target made of canvas, and placed so that it should slide from the top to the bottom of a scaffold 40 ft. high. In consequence of the spray from a jet being of little service when enlarged or radiated beyond 6 ft.—owing to evaporation—the target was only 6 ft. in diameter. The water thrown into it was conducted by a "shoot" into a measure tub, so that the quantity projected might be accurately ascertained. The experiments were conducted by Mr. Superintendent Tozer, in the presence of Captain Palin, the chief constable, and several members of the Watch Committee. Each engine was tested in ten different ways, and the result showed that in 14 minutes and 26 seconds Messrs. Shand and Mason's engine threw 2,482 gallons with 760 strokes, to project 1,500 gallons into the target, the loss being at the rate of about 35 gallons in every 100. In 12 minutes and 53 seconds Mr. Rose's engine threw 2,374 gallons with 632 strokes, to project 1,500 gallons into the hood, the loss being at the rate of about 34 gallons in every 100. The volume of water that was lost was probably greater than would have been the case had the weather been more favourable. With regard to other conditions than those of quantity and force of water projected—such as price, &c.—Mr. Tozer reports more favourably of Mr. Rose's engine than that of his competitors. The result of the trial and Mr. Tozer's report are at present under the consideration of the Watch Committee.—*Manchester Guardian.*

BECK'S METAL-CUTTING MACHINE.



BECKS' METAL-CUTTING MACHINE.

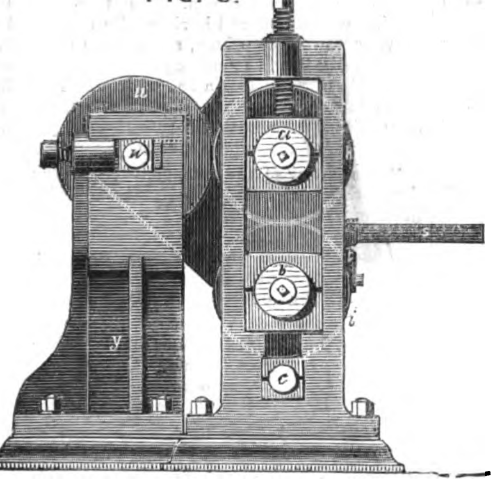
A PATENT has just been obtained by Mr. A. T. Becks, of Birmingham, for an invention for improvements in machinery for cutting or shearing the sides and ends of sheets or plates of metal.

The invention consists in arranging and working a series of rotating cutters in the manner hereinafter explained. Two parallel horizontal shafts situated the one over the other are driven by steam or other power by means of a pinion on a driving shaft. The pinion engages with a toothed wheel on the lower shaft, the toothed wheel engaging with a similar toothed wheel on the upper shaft. Each of the shafts carries, near the end opposite to that on which the toothed wheel is fixed, a circular or rotating cutter. These cutters are fixed on the shafts, and their cutting edges meet and cut one side of the plate or sheet of metal operated upon. The shafts are hollow, and in the axis of each a screw is situated. A screw-nut or box works on the screw in the interior of each hollow shaft. By turning the screws by a winch or otherwise the screw-nuts may be made to travel in one or other direction on the screws. A second circular or rotating cutter capable of a sliding motion is situated on each shaft, and is connected with the screw-nut or box in the shaft through a slot running nearly from end to end of the shaft. By turning the screws the moveable cutters may be made to approach to, or recede from, the cutters fixed on the shafts, so as to accommodate the distance between the cutters to the width of the plate or sheet to be cut or sheared. By passing the plate or sheet or sheets of metal through the machine in a horizontal direction, both their edges or sides are simultaneously cut or sheared parallel. The ends of the plates are cut by means of a fifth cutter, forming a pair with the fixed cutter on the upper shaft. This fifth cutter is fixed on a horizontal shaft situated parallel to, and in the same horizontal plane as, the upper hollow shaft, and is geared to the upper hollow shaft by a toothed wheel taking into a toothed wheel on the hollow shaft. The ends of the plate or sheet are cut or sheared one end at a time by passing them in a vertical direction between the last-described pair of cutters. The cutting or shearing may be affected without the fifth cutter, by passing the plate in a horizontal direction between the fixed pair of rotating cutters described, the plate being supporting on a moveable table.

Fig. 1 represents a front elevation; Fig. 2, a back elevation; and Fig., 3 an end elevation of the machine.

a, *b*, are parallel horizontal shafts situated one over the other, and driven from the main shaft *c*. Motion is communicated to the shaft *c* by means of the toothed wheel *d*, and the motion of the shaft *c* is transmitted through the pinion wheel *e* and toothed wheel *f* to the shaft *b*. A toothed

FIG. 3.



wheel *g* on the shaft *a* gears with the toothed wheel *f* on the shaft *b*, and communicates motion to the upper shaft *a*. Each of the shafts *a*, *b*, carries a fixed circular cutter marked *h* and *i* respectively, the cutting edges of the said cutters working in contact or nearly in contact. On the opposite ends of the shafts *a*, *b*, are two other rotating cutters *o*, *p*, capable of being made to slide along the said shafts *a*, *b*, and thereby to approach to or recede from the fixed rotating cutters *h*, *i*. The shafts *a*, *b*, are hollow, and are furnished respectively with screws *k*, *l*, situated in their axes. Each of the screws *k*, *l*, passes through a screw-nut or screw-box carried by the collars *m*, *n*, of the moveable cutters *o*, *p*, the said screw boxes passing through slots *q* in the hollow shafts *a*, *b*. By turning the screws *k*, *l*, by winches applied to the square ends, the moveable cutters *o*, *p*, may be brought to the required distance from the fixed cutters *h*, *i*, that is, to to the distance equal to the width to be given to the cut or sheared plate, sheet, or sheets. By passing the plates or sheets of metal to be cut or sheared through the machine in a horizontal direction, both their edges or sides are simultaneously cut or sheared parallel. The plates are supported in their passage through the machine on the table *s*, the table being capable of being raised or lowered by means of screws and slots at *t*.

When the machine is to be used for cutting or shearing the ends of the plates or sheets of metal, a fifth cutter *u* is added. This cutter is carried by the shaft *w*, supported on a standard *y*, and rotary motion is given to the shaft *w* by a toothed wheel *x* thereon gearing with the toothed wheel *g* on the upper hollow shaft *a*. The cutter *u* forms with the fixed cutter *h* a pair of cutters, by means of which the cutting or shearing of the ends of the plate is effected. The plates are held in a vertical plane, and are made to descend vertically between the cutters *h*, *u*. After one end of the plates have been cut or sheared, they are turned, so as to bring the other end under the operation of the cutters *h*, *u*.

INSTITUTION OF CIVIL ENGINEERS.

THE Council of the Institution of Civil Engineers have awarded the following premiums for Papers read at the meetings during the session 1862-63:—

1. A Telford medal, and a Telford premium, in books, to John Brunton, M. Inst. C.E., for his "Description of the Line and Works of the Scinde Railway."

2. A Telford medal, and a Telford premium, in books, to James Robert Mosse, M. Inst. C.E., for his Paper on "American Timber Bridges."

3. A Telford medal, and a Telford premium, in books, to Zerah Colburn, for his Paper on "American Iron Bridges."

4. A Telford medal, and a Telford premium, in books, to Harrison Hayter, M. Inst. C.E., for his Paper on "The Charing Cross Bridge."

5. A Telford premium, in books, to William Michael Peniston, M. Inst. C.E., for his Paper on "Public Works in Pernambuco, in the Empire of Brazil."

6. A Telford premium, in books, to William Henry Preece, Assoc. Inst. C.E., for his Paper "On Railway Telegraphs, and the Application of Electricity to the Signalling and Working of Trains."

7. A Telford premium, in books, to Alexander Woodlands Makinson, M. Inst. C.E., for his Paper "On some of the Internal Disturbing Forces of Locomotive Engines."

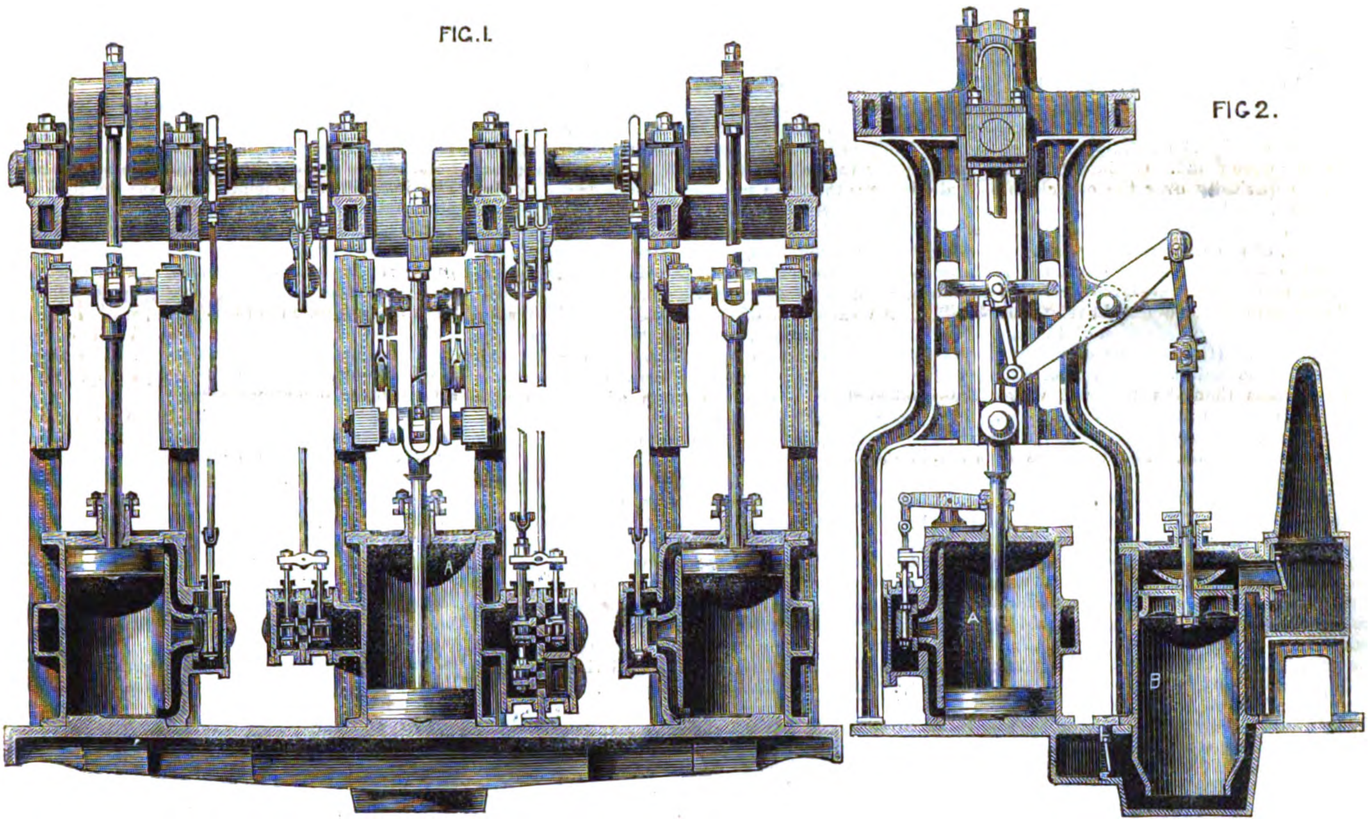
8. A Telford premium, in books, to Daniel Miller, for his Paper on "Structures in the Sea, without Cofferdams,—with a Description of the Works of the New Albert Harbour at Greenock."

9. A Telford premium, in books, to Robert Crawford, Assoc. Inst. C.E., for his Paper on "The Railway System of Germany."

10. A Telford premium, in books, to William Cudworth, M. Inst. C.E., for his Paper on "The Hownes Gill Viaduct, on the Stockton and Darlington Railway."

11. A Telford premium, in books, to James Grant Fraser, M. Inst. C.E., for his Paper "Description of the Lydgate and of the Buckhorn Weston Railway Tunnels."

HENDERSON'S IMPROVEMENTS IN STEAM-ENGINES.



12. A Watt medal, and the Manby premium, in books, to John Fernie, Assoc. Inst. C.E., for his Paper "On the Manufacture of Duplicate Machines and Engines."

HENDERSON'S IMPROVEMENTS IN STEAM-ENGINES.

THE above engravings illustrate an invention recently patented by Mr. G. Henderson of Mincing-lane.

The invention consists in a peculiar combination of parts, by which it is proposed that some of the steam generated may be used in two or more cylinders in succession without that back pressure on the piston in the first cylinder which has heretofore resulted when using steam expansively in two or more steam cylinders. The combination is such that each of the steam cylinders is capable of being put in communication with a condenser or with the outer atmosphere on one side of the piston when steam is being admitted into the cylinder on the other side of the piston. To accomplish this, the steam is expanded from the first steam cylinder A, into a vessel or accumulator B, from which the steam is supplied to another steam cylinder C, the communication between the first steam cylinder and the accumulator being closed by a suitable valve when steam from the accumulator is being supplied to the second steam cylinder. The working of the machinery is such that on opening the exhaust from the first steam cylinder, the steam expands into the accumulator of the second steam cylinder and then to the condenser, if only one additional cylinder be employed; but if more than one additional steam cylinder be used then, the exhaust having been opened to the first accumulator, it is cut off therefrom, and the exhaust steam is then allowed to expand into a second accumulator of the second additional steam cylinder before the exhaust of the first cylinder is allowed to pass to the condenser.

AMERICAN COLLIERY ENGINEERING.

A CORRESPONDENT of the *Scientific American* writes as follows:—On the Ashland estate, in the vicinity of the town of Ashland, are located two large collieries—one, worked by Bancroft, Lewis, and Co., employing between four and five hundred hands; and the other, worked by Mr. Moody, almost as many. These collieries are situated on opposite sides of the Mahanoy creek, and the slopes in each have been sunk to the depth of 600 ft. perpendicular. The mining engineer of the estate, seeing the great advantage to be derived from having the draining of both mines effected by one pump, proposed that an engine should be constructed of sufficient power to perform the required work. A direct-acting engine of 500-horse power was built by the firm of Pott and Vastine, of Pottsville, and erected at Bancroft's colliery, and having been found to work satisfactorily, the work of connecting the two collieries was commenced. This, as all engineers will understand, was a most difficult undertaking. The intervening distance between the two slopes consisted partly of precipitous mountain side; and the slopes, following the pitch of the vein to the depth of 600 ft., were very steep and unfavourable for the use of instruments. A small gangway, merely large enough to allow the workmen room, was started at 500 ft. below the water-level in the eastern colliery, and driven forward with the intention of meeting a similar gangway from the western colliery; but as the miners advanced, the influx of water became greater, and finally, owing to some accident to the pump, drove the men out and arose 300 ft. in the slope, completely drowning out the lower part of the mine. The western gangway was then driven to within 60 ft. of the flooded gangway, and preparations made for boring through the intervening mass of coal and slate. A strong battery of heavy timber was first erected to prevent the washing away of the coal by the immense pressure of the 300 ft. of water about to be tapped. The drill was then put into operation, and with such nicety and skill had the gangways been driven, and so exactly was the direction of the drill determined, that the water was struck at the first attempt. Only from an actual inspection of the collieries can an idea be formed of the delicacy of levelling and measurement required to execute succesfully such a work, where the smallest error in the direction of slope of the gangways would involve everything in inextricable confusion. Mr. H. H. Fisher, the engineer under whose direction the work was performed, has had for several years the entire control of the engineering department of the Ashland estate, upon which are stuated some of the largest collieries in Schuylkill county.

RESEARCHES ON RADIANT HEAT.*

IN his former researches on the radiation and absorption of heat by gaseous matter, the speaker com pared different gases and vapours at a common thickness with each other; one part of his present object was to compare different thicknesses of the same gaseous body with each other as to their action upon radiant heat. A few years ago he would be deemed a bold man who would attempt to measure the action of an inch, or indeed of many feet of a gas, on radiant heat; but the present experiments commence with plates of gas only 0·01 of inch in thickness, and extend to thicknesses of 49·4 inches. Thus, the greatest thickness is to the least nearly in the ratio of 1 to 5,000. The apparatus employed for the smaller thicknesses was a hollow cylinder, one end of which was closed by a plate of rock-salt. Into this fitted a second cylinder, with its end also closed by a plate of the salt. One cylinder is moved within the other like a piston, and by this means the two plates of salt could be brought into flat contact with each other, or

* Abstract of Paper read before the Royal Institution June 12, by JOHN TYNDAL, Esq., F.R.S.

could be separated to any required distance. the distance between the plates was measured by a *vernier*. The cylinder was placed horizontal, being suitably connected with a source of heat. This latter consisted of a plate of copper, against which a steady sheet of flame was caused to play.

The absorption of radiant heat by carbonic oxide, carbonic acid, nitrous oxide, and olefiant gas was determined with this apparatus, and such differences as might be anticipated from former researches were found. Olefiant gas maintained its great superiority over the other gases at all thicknesses. A layer of this gas, not more than 0·01 of an inch in thickness, intercepted about 1 per cent. of the total radiation; and the delicacy of the apparatus may be inferred from the fact that this absorption—great, relative to the thickness of the layer of gas, but small absolutely—corresponded to a deflection of 11 degs. of the galvanometer. (It would be certainly possible to measure the action of a layer of this gas of less thickness than the paper on which these words are printed.) A layer of olefiant gas, 2 in. in thickness, intercepts nearly 30 per cent. of the entire radiation. The influence of a diathermic envelope surrounding a planet may be strikingly illustrated by reference to this gas. A shell of olefiant gas 2 in. thick, surrounding the earth, would offer no appreciable hindrance to the solar rays in their earthward course; but it would intercept, and in great part return, 30 per cent. of the terrestial radiation: under such a canopy the surface of the earth would probably be raised to a stifling temperature. A layer of the gas, 3-10ths of an inch thick, intercepts 11·5 per cent. of the whole radiation. Such a layer if diffused through a stratum of air 10 ft. thick, would be far more attenuated than the aqueous vapour actually diffused through the air; still it would produce an absorption greater than that which the speaker had assigned to the atmospheric vapour within 10 ft. of the earth's surface. In the presence of such facts, the arguments which we might be disposed to base on the smallness of the quantity of atmospheric vapour are entirely devoid of weight.

In measuring the action of larger thicknesses of gas, the following method was pursued:—A brass cylinder, 49·4 in. in length, had its two ends stopped with plates of rock salt, and a suitable source of heat placed at one end; the rays from this source passed through the tube, and were received by a thermo-electric pile placed at its opposite end; this radiation was exactly neutralized by the heat emitted from a cube of boiling water and incident on the opposite face of the pile. The interception of any portion of the heat emanating from the source by a gas or vapour introduced into the tube destroyed the equilibrium previously existing, and the amount intercepted was declared by the galvanometer. The thickness traversed by the calorific rays was varied in the following way:—The tube was divided into two distinct compartments by the introduction of a third plate of rock salt. Let us agree to call the compartment most distant from the pile the first chamber, and that adjacent to the pile the second chamber. The experiments began with the first chamber short and the second chamber long, and ended with the first chamber long and the second chamber short. The alteration consisted solely in the shifting of the intermediate plate of salt, which lengthened the first chamber and diminished the second one by the same quantity; the sum of the length of both chambers being the constant quantity, 49·4 inches.

The absorption effected in the first chamber acting alone was first determined; then the absorption effected in the second chamber acting alone; and, finally, the absorption effected when both the chambers were occupied by the gas or vapour. This arrangement enabled the speaker to check his experiments, and also to examine the effect of the shifting which occurred in the first chamber on the absorption of the second one. The thermal coloration of the various gases was rendered strikingly manifest by these experiments; for the vast majority of the rays—for example, carbonic oxide and carbonic acid—are transparent. Placing a stratum of carbonic oxide, 8 inches in length, in front of a column of the same gas, 41·4 inches long, these 8 inches intercepted 6 per cent. of the whole radiation; placed behind a column, 41·4 inches long, the absorption of the same 8 inches was sensibly *nil*. So also with carbonic acid; 8 inches in front absorbed 6½ per cent., while placed behind the effect was almost zero. Similar remarks apply to the other gases, the reason manifestly being that when the 8-inch stratum is in front, it stops the main portion of the rays which give it its thermal colour, while, when it is placed behind, these same rays have been almost wholly withdrawn, and to the remaining 94 per cent., or thereabouts, of the radiation the gases are sensibly transparent.

An extension of this reasoning enables us at once to conclude, that the sum of the absorptions of the two chambers taken separately must always be greater than the absorption effected by a single column of the gas of a length equal to the sum of the two chambers. This conclusion is illustrated in a striking manner by the experiments; and it is further found that when the mean of the sums of the absorptions is divided by the absorption of the sum, the quotient is sensibly the same for all gases. It may also be inferred from considerations similar to the foregoing, that the sum of the absorptions must diminish, and approximate to the absorption of the sum, as the two chambers become more unequal in length, and that the sum of the absorptions of the two chambers is a maximum when the medial rock-salt plate divides the long tube into two equal compartments.

In these days a special interest attaches itself to the radiation of any gas through itself or through any other gas having the same period of vibration. The speaker referred to the results of an elaborate series of experiments on this interesting question. The experimental tube, 49·4 inches long, was divided into two compartments by a partition of rock salt. All external sources of heat were abolished, and the pile, furnished with its conical reflector, stood at the end of the tube. The compartment nearest the pile contained the gas which was to act as absorber, while that most distant from the pile held the gas which was to act as radiator. It is known that the destruction of the motion of a sensible mass of matter is always accompanied by the evolution of heat. A weight falling to the earth, and a ball striking a target, are heated on collision. The same is true for atoms, and in the present experiments the gas in the radiating chamber was heated by the collision of its own particles against the inner surface of the tube when they rushed in to fill the vacuum. The radiation was, in fact, what the speaker had named "dynamic radiation." The lengths of the two chambers were varied, the radiating column being lengthened and the absorbing one shortened at one and the same time; the sum of both was always the constant length 49·4 inches.

The experiments with the vapours were thus executed. Both the chambers into which the tube was divided were, in the first place, occupied by the vapour to be examined; the usual pressure being 1-60th of an atmosphere. The entrance of the vapour was so slow, and its quantity so small, that the radiation due to the warming of the vapour by its own collision was insensible. The needle being at zero, dry air was allowed to enter the chamber most distant from the pile. This air became heated dynamically, communicated its heat to the vapour, and the latter immediately discharged the heat thus communicated to it against the pile. It is quite evident, that not only does this case resemble, but that it is actually of the same mechanical character as that in which a vibrating tuning-fork is brought into contact with a surface of some extent. The fork, which before was inaudible, becomes at once a copious source of sound. What the sounding-board is to the fork, the compound molecule is to the elementary atom. The tuning-fork vibrating alone is in the condition of the atom radiating alone, the sound of the one and the heat of the other being alike insensible. But in association with sulphuric or acetic ether-vapour the elementary atom is in the condition of the tuning-fork applied to its sound-board, communicating through the molecule motion to the luminiferous ether, as the fork through the board communicates its motion to the air.

The experiments demonstrate the great opacity of a gas to radiations from the same gas. They also show in a very striking manner the influence of attenuation in the case of vapour. The individual molecules of a vapour may be powerful absorbers and radiators, but in thin strata they constitute an open sieve through which a large quantity of radiant heat may pass. In such thin strata, therefore, the vapours as used in our experiments, were generally found far less energetic than the gases, while in thick strata the same vapours showed an energy greatly superior to the same gases. The gases, it will be remembered, were always employed at a pressure of one atmosphere.

A few striking experiments were referred to in illustration of the influence of a paper lining, or a coat of varnish or lampblack, within the experimental tube. In dynamic radiation it is not possible to do entirely away with the action of the interior surface of the tube itself. When the tube is of brass and well polished within, the entrance of the air produces a deflection of 7·5 degrees, this being due to the emission from the warmed surface of the tube. A lining of paper, 2 feet long, raises the radiation sufficiently to drive the needle through an arc of 80 degrees, while a ring of paper, 1½ inches long, placed within the tube radiates sufficient to urge the needle through an arc of 56 degrees.

The speaker finally examined the diathermancy of the liquids from which his vapours were derived, and the result leaves no shadow of a doubt upon the mind, that both absorption and radiation are molecular phenomena, irrespective of the state of aggregation. If any vapour is a strong absorber and radiator, the liquid whence it comes is also a strong absorber and radiator. The molecule carries its power, or want of power, through all its stages of aggregation. The order of absorption in liquids and vapour is precisely the same; and the speaker looked forward with hope to the application of these results to other portions of the domain of thermotics.

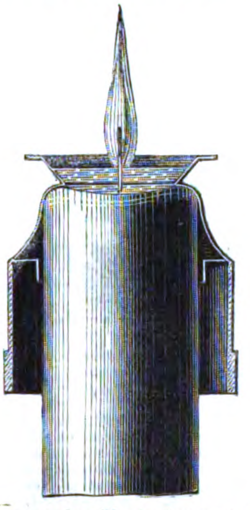
SINGULAR ELECTROLYTIC ACTION.

MR. ABEL, the Chemist of the War Department, lately communicated to the Chemical Society the results of his observations on the blistering of the lead coatings of a few of the iron projectiles commonly used in Sir William Armstrong's rifled ordnance. The shot consists mainly of cast-iron, and for the purpose of fitting tightly the bore of the gun, is coated with an alloy known as "soft metal," which consists of lead mixed with a small proportion either of tin or antimony; the steps of the manufacture being thus described:—According to one plan, the iron is turned down a little smaller than the required gauge, and then grooved out or "undercut" so as to present a number of projecting ridges by which the attachment of the lead is afterwards secured; it was then found that the unequal rates of expansion ultimately severed the connection of the two metals, and gave rise to inequalities upon the finished surface. These were, however, very different in appearance from the blisters which were discovered under some circumstances to be produced upon shot coated by the second or "galvanizing" process; to illustrate which Mr. Abel exhibited a photograph of the 110-lb. shot which was sealed as a pattern in November, 1861, and had been kept in a glass case since that time. Besides several small blisters, one of these measured 1·1 inch in width, and was raised about a quarter of an inch from the true surface. On puncturing this under water, a somewhat considerable volume of gas escaped, which on careful examination proved to be pure hydrogen, and on comparing then the bulk of gas collected, with the internal capacity of the blister, it was found to have existed under a pressure of ten atmospheres. Reverting now to the process of manufacture, the origin of this gas would become apparent. The iron shot were turned flush, and coated with zinc as preliminary to the attachment

of lead; this was accomplished by heating the projectiles directly they left the lathe, in an oven which was graduated so as eventually to impart a temperature nearly that of the fusing point of zinc; they were dipped for a moment into a solution of sal-ammoniac, and then immediately into a bath of melted zinc; from this they were passed directly into a bath of "soft metal," which adhered perfectly to the galvanized surface, and this coating could then be increased to any extent by supporting the shot in a mould and pouring the lead alloy around it. Among a vast number of Armstrong projectiles which had been made in this manner, a very small proportion only exhibited the peculiarities described, and no practical inconvenience had been felt sufficient to warrant a change in the process, since these blisters when observed might easily be punctured and flattened down, the small orifice being afterwards closed with solder. It was evident that water, or some hydrogen compound must be enclosed at an early stage of the process, and afford by its electrolytic decomposition, the gas which, gradually accumulating, exerted the disruptive action already noticed. In tracing its probable origin, Mr. Abel discovered that chloride of zinc, when once combined with water, could not be again rendered perfectly anhydrous by exposure to a degree of heat somewhat above the melting point of zinc; for on throwing fragments of zinc into the fused chloride they were quickly melted, giving rise to the production of hydrogen gas, and the formation of an oxychloride of the metal. It was not difficult to suppose a similar change occurring in the lapse of time at the ordinary temperature; chloride of zinc would undoubtedly be formed by the action of the sal-ammoniac flux upon zinc or its oxide, and this might readily attach itself to slight asperities upon the surface of the shot, become hydrated, and ultimately enclosed within the lead coating. The torn, fibrous aspect of the metal on the inner surfaces of the blister, and the detection of chlorine in the cavities, confirmed these opinions, and pointed directly to the origin of these remarkable appearances upon the Armstrong shot.

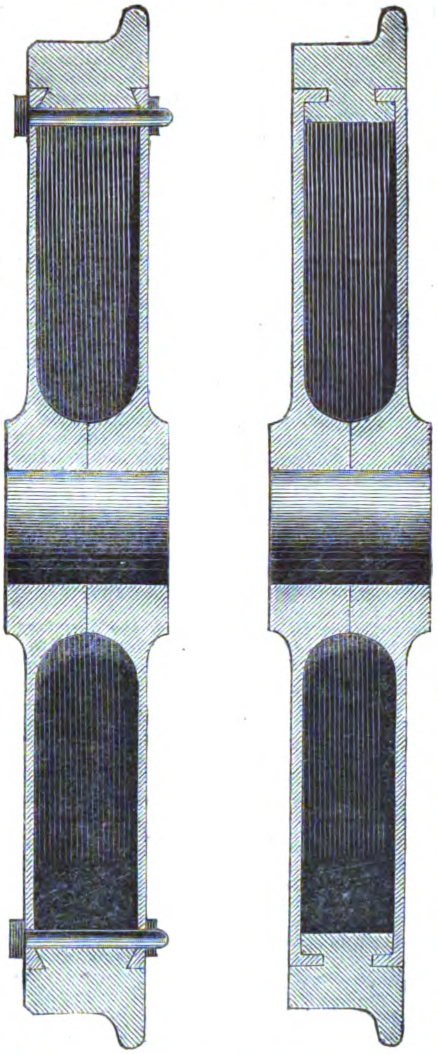
The President expressed his surprise on hearing that so thin a coating of lead had effectually prevented the diffusion of the hydrogen.—Dr. Franklin inquired whether these blisters appeared at once, or only after the lapse of time.—Mr. Abel replied that the whole of these projectiles had passed an inspection before being received into store, and that it was only on subsequent examination that the faults were noticed. Some few instances were reported from distant stations, and all were doubtless the work of time.

CHARLES' CANDLE NOZZLE.



THE above engraving illustrates a candle nozzle of an improved form, just patented by Mr. A. P. Charles, of Wapping. The invention consists of a cap or nozzle to fit over a candle; it is furnished with a cup or reservoir to contain the melted tallow. As the candle burns downwards, the nozzle descends by its own weight. The wick being very thin, when blown out can be readily relighted, which is not the case with candles known as "night lights." The candles may be of any length. The nozzle is particularly adapted for candles burning in candelabras, halls, &c.

WILSON'S RAILWAY WHEELS.



THE invention, shown in the above engravings, relates to a peculiar construction and arrangement of railway wheels, whereby greater economy and simplicity of construction are combined with increased safety in cases of fracture of the tyre. The invention has been patented by Mr. E. B. Wilson, of Parliament-street.

Two discs of the desired size are first prepared by forging or casting, and are then placed in dies and subjected to compression or hammering therein for the purpose of giving them the desired form, whether flat, dished, or corrugated. These dies are also so shaped as to produce a raised annular rim all round the circumference of the discs on one side thereof, such rim being either parallel, V-shaped, or of any other sectional form. The tyre has corresponding annular grooves formed inside it, so as to fit accurately over or on to the rims of the two discs which are placed inside the tyre from opposite sides thereof, and may or may not be held therein by bolts passing through the discs. The space between the discs may be filled in with india rubber, cork wood, or other good sound deadening material. The discs may be cast in steel or malleable metal, or made of "uses" under the steam hammer, and then rolled by means of conical rollers. The compressing, hammering, or rolling of the discs and tyre may be done at the time of casting or forging or subsequently by re-heating.

A gentleman resident in Cuba informs us that the utmost activity prevails there with regard to laying out of new properties and the erection of steam machinery, and that at least 25,000 slaves have within the last year been imported from Africa.

TO CORRESPONDENTS.

RECEIVED.—A. B.—G. R. F.—B. Brothers.—F. A. P.—J. N.—W. B.—L. S. M.—J. N.

B. BROS. (Newport, Mon.)—Please address Mr. Holdway, carriage builder, Mount-street, Grosvenor-square, W. There are other parties engaged in this business, but we do not know their exact addresses. Since writing the article on *titaniferous iron ores*, we have ascertained, from a source upon which we can rely, that iron ores in a similar state of aggregation—that of minute subdivision—have been successfully reduced in France, by working them up into balls with clay, to be afterwards smelted in the blast furnace.

NAUTICUS.—We have received a letter from this correspondent, in which he expresses surprise that the merits of Mr. Vaile's propeller have not been discussed by other correspondents in our pages. He goes on to say, "I must confess that I should like your correspondents to be as candid in relation to Mr. Vaile's propeller as you yourself have been. Possibly your insertion of this brief note of interrogation may lead to a response."

W. B.—Your invention is not new. It has been patented as a mine-pump valve (for which it has failed) two or three years ago.

W. ROBERTS (Millwall).—We have received a letter from this gentleman stating that he had steam first at Sydenham, and that the quantity of water which he lodged in the large tank during the first hour was exactly 20 in., precisely the same performance as Shand's large engine.

T. O. F.—We have not received the sketch which explains your letter, and cannot express any positive opinion till we do. As far as we can judge, the first invention seems good.

A. MUNTZ.—We scarcely understand the drift of your letter. Please explain what you want us to do.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

VAILES' PROPELLER.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—From a careful perusal of your excellent article on "Marine Engine Improvement," which appeared in the MECHANICS' MAGAZINE of the 12th ult., and also your remarks on the pamphlet lately published by Mr. Vaile, describing his system of propulsion, as well as an attentive examination of the pamphlet itself, I am convinced, somewhat against my prejudices, that his propeller is adapted to forward those improvements in marine engines which you advocate.

Any one who has read that pamphlet, cannot fail to have noticed that all the useful effect of a 40 ft. paddle-wheel can, on the principles there advocated, be produced by chain-wheels only 5 ft. in diameter, thus reducing the leverage against the engines from 20 ft. to 2 ft. 6 in.

Now, assuming any number—say 5 tons—as the actual pressure of the water on the float of a 40 ft. paddle-wheel when the ship is making 14 knots, then it follows, supposing the same ship to be fitted with Vaile's propellers, having floats of similar areas, that the pressure on their floats would also be 5 tons when the vessel was moving at the same rate of speed. But here is the important difference between the two propellers: in the paddle-wheel this pressure of 5 tons would be at the end of a 20 ft. leverage against the engine, while in the Vaile propeller it would be at the end of a leverage of only 2 ft. 6 in.

A pair of these propellers, so constructed that each of their floats should contain half the area of the largest screw propeller made, and consequently the two together equal its entire area, would form a compact propelling apparatus, not requiring chain-wheels of more than 3 ft. in diameter, and a space of 5 ft. from centre to centre of their shafts; such a space between the shafts would give to each float, while in the act of propelling, a continuous horizontal stroke of 5 ft.

From these comparisons of the new propellers with the paddle-wheel and screw, it will be readily seen, that exceedingly small engines may be used to drive it, and thereby both steam-power and stowage room in the vessel saved, and great economy in the first cost and working of the engines effected. A pair of such propellers, driven by separate engines of the locomotive class, would, I think, produce good results, not the least of which would be the

steering power gained by the independent action of the engines and propellers, and also a better distribution of steam power round the shaft when steaming ahead, which would be obtained by arranging the cranks on the shafts of each engine at such angles that, when connected by the intermediate shaft, it would form a four-throw shaft, no two cranks of which would be at their dead points at the same moment of time.

I can see no reason why such chains as are shown in the pamphlet should not be driven at high rates of speed. The pins connecting the rods, of which the chain is formed, can be made of large diameter, and the bearing surface for these pins, in the rods, can be made of any required breadth, so that ample provision is obtainable for all possible wear-and-tear.

I am, Sir, your obedient servant,

Observer.

Miscellanea.

We learn that the Hamburgh show is likely to prove a great success. The number of animals entered is 8,800, and of implements 1,500.

The hinges of the new oaken door lately put up at Hereford Cathedral cost £140, and were executed by Porter, of London.

We learn from the *Times* that orders have been received at the head-quarters of the Royal Engineer establishment, Chatham, from the Horse Guards, directing a number of the most experienced telegraphists, who have completed their course of instruction at the School of Telegraphy, Brompton Barracks, to be selected from the companies at head-quarters, to be despatched to Turkey to assist in laying down a telegraph line through that country and Persia, to India. It is expected that the expedition to be despatched from Chatham will be occupied for about five years in the undertaking.

An important survey of guano deposits on the coast of Peru has been concluded, and the stocks are estimated at 1,500,000 tons on the Macabi islands, 2,500,000 tons on the Guanape group (opposite the point of St. Helena), and 4,000,000 tons on the Lobos island, representing a total value of 230,000,000 dollars, or £46,000,000 sterling. There is every probability of a magnificent dock being speedily erected at Callao, which will be the clearing port for guano vessels from all these islands.

At the close of the year 1862 there belonged to the ports of the United Kingdom 28,440 vessels of 4,934,400 tons, usually navigated by 228,139 men and boys—an increase in the course of the year of 402 vessels, 127,574 tons, and 3,315 men and boys. The vessels belonging to the British plantations were 10,967, of 1,107,696 tons, and manned by 75,934 persons.

The Royal yacht "Osborne" made an official trial of her machinery on Wednesday at Portsmouth. She has been fitted with new feathering wheels by Messrs. Maudslay and Field. The speed attained by the yacht is nearly three-quarters of a knot in excess of what she realized when a new vessel 20 years since, and the trial may therefore be considered in the highest degree satisfactory.

A Joint-Stock Association, under the title of the Lancashire Steel Company (Limited), have arranged with Messrs. Bessemer and Longsden to work their patents on payment of certain royalties upon the steel produced. They propose to erect suitable buildings, furnaces, blast engines, converting vessels, hydraulic cranes, steam hammers and rolling mills, capable of making a single block of steel of 10 tons weight, and of producing 200 tons of steel per week, adapted for rails, locomotive engine tyres, axles, crank shafts, marine engine shafts, piston rods, shafting, boiler and ship plates, cannons, mortars, girder bridge plates, &c., and for all purposes where it is desirable to substitute Bessemer steel for iron. It has hitherto been rather disgraceful to English enterprise that we were unavoidably compelled to send to the Continent for the larger proportion of our heavy steel forgings or castings. We wish the company every success therefore, and trust that it will efficiently supply a want long felt.

A prospectus has been issued of the Newport (Monmouthshire) Dry Dock Wood and Iron Shipbuilding and Ship Repairing Company, with a capital of £100,000, in shares of £20. Mr. Crawshay Bailey is the chairman, and the object is to purchase some existing works and greatly to extend the shipbuilding trade of the port of Newport.

Dr. Haines, of Grant College, Bombay, describes the occurrence in vast quantities of naturally formed carbonate of soda in the neighbourhood of Aden. The substance as found contains 50 per cent. of natural carbonate, and occurs along the coast, for ten miles at least to the east of Aden, in hollows behind high-water mark, to which the sea has access by percolation. Its formation is attributed to the percolation of the sea-water through the fragments, and pebbles of limestone constituting the shingle of the shore, probably by the partial interchange of elements between the salt or chloride of sodium and the carbonate of lime giving rise to the production of chloride of calcium and carbonate of soda. It is surmised that the formation of carbonate of soda may go on along the whole thousand miles of the south-east Arabian coast.

On Friday last a barque named the "Virginia" was launched at Liverpool from the building yard of Mr. John Robinson, south side of Duke's Dock. The launch, though attended with some apparent difficulty, consequent on the marked difference between the level of the building yard and the river, a height of ten feet, was accomplished in perfect safety. The "Virginia" is a ship of somewhat peculiar construction, the principle having been patented. Her bottom is flat, and she has three keels, in addition to which only straight timber is employed in the building. Her length is 115 ft., beam 23 ft., and depth of hold 12 ft. Her registered tonnage is 200 tons, but has carrying capacity equal to 500 tons, and is classed for seven years at Lloyd's. The time occupied in building the "Virginia" was only 40 days and 40 nights, and she was launched with her masts and a portion of her rigging fitted.

On Tuesday night Mr. Ferrand gave notice that he would, on Thursday next, ask the Secretary for the Home Department, whether his attention had been drawn to the great destruction of life by the constant bursting of steam boilers, especially by the bursting of one near Leeds a few days ago, when ten people were killed; and, if so, whether steam boilers ought not to be placed under Government inspection. In a recent leader we advocated such a supervision, and we are pleased to see that the attention of Government is about to be called to the matter.

The directors of the works of the Modane and Bardonèche tunnel have published their report at Turin. It appears that at the close of 1862 the total length of the tunnel pierced was 2,199 metres, viz., 1,274 on the Bardonèche, and 925 on the Modane side. The measures taken for increasing the supply of compressed air were successful. As regards the time necessary for completing the work, the directors express a belief that it will be considerably shorter than 12½ years, the limit lately calculated by the Minister of Public Works. The convention with France allows 25 years. The total length of the tunnel being 12,220 metres, the expense, calculated at 4,000f. per metre, will amount to about 50 millions of francs. The railroad from Bardonèche to Sussa will be 40 kilometres in length, with a gradient of 19·325 per 1,000, and 6,500 metres through tunnels, the longest of which, near Exilles, will measure 1,170 metres.

During his speech on Tuesday week, in the House of Commons, upon the Board of Works, Mr. B. Cochrane mentioned the fact that it had been proprosed to place a floating light on the Little Basses Rocks, Ceylon, and that an hon. member had recently stated:—"These rocks were in the direct line of the steamers between Point de Galle and Madras, and as early as 1826 it was represented to the Government that they ought to be lighted. In 1848 the Government made up their minds to do something, and wrote to Ceylon for advice how lighthouses could be erected. Six years afterwards, in 1854, they got reports showing that floating lights were impracticable, and strongly recommending the building of light houses on both the Basses Rocks for the estimated sum of £4,500. In 1855, Parliament voted £3,000; in 1856, £17,000, and £6,000 for a steamer to carry the materials; in 1857, £8,000; in 1858, £10,000; and in 1859, £10,000, making a total of £54,000, for which there was never any other estimate than the one of £4,500. The lighthouse was not put up, and he saw it on the wharf at Point de Galle. In 1860 they were told that they could not put up a lighthouse, and that they must have a floating light, which was in the first instance condemned. Accordingly, in 1861 the House voted £8,000, and in 1862 £2,000 more for a floating light. The money was not expended, and now they were asked to vote £8,000." The whole of these sums, said Mr. Cochrane, made a total of £80,000; and the proceeding appeared to be most reckless and extraordinary.

A contemporary describes a most ingenious machine, for registering music instantaneously as played, invented and patented by Mr. Beverley Fenby, of Bute Villa, St. John's, Worcester. It will afford to the composer, whether professional or amateur, the means of instantaneously recording his ideas in an enduring form and as plainly intelligible as the usual printed musical books. The machine is small, and the motive power is electro-magnetic, produced by a voltaic battery, and working in a manner analogous to the printing telegraph. The machine having been placed *en rapport* with the instrument to be played upon, say painoforte, harmonium, or organ, the player manipulates the keys in the usual manner, and the machine prints his performance as he goes along, at a speed proportionate to his playing, the usual rate being 15 in. of paper per minute. The printed notation is identical with that already in use, the only difference being that the heads of the notes are square instead of round. The sharps, flats, ledger lines, and every musical sign, are the same as those used for the piano and organ. The printing is clear and well defined, and the performer feels not the least impediment or hindrance to his playing, from the machine, however rapid and complicated his style may be. The machine and battery are very compact, and the whole is enclosed in a case; the only communication between it and the keys of the piano are the wires of the battery, which are touched by a small key and spring fixed beneath the keys. The case can be placed either by the side of the piano or in another room at whatever distance, so long as there is the communication by the wires. The performer composes, plays, and prints at one and the same time.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgment:—

Steam Engines, &c., 3294, 3337, 3340.
Boilers and Furnaces, 3307.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3316, 3339, 3343.
Ships and Boats, including their fittings, 3332, 3333, 3344.
Cultivation of the Soil, including agricultural implements and machines, 3325, 3338.
Food and Beverages, including apparatus for preparing food for men and animals, 3296, 3299, 3308, 3323, 3324, 3342, 3345, 3348.
Fibrous Fabrics, including machinery for treating fibre, pulp, paper, &c., 3301, 3306, 3313, 3319, 3321, 3329, 3330, 3336, 3341, 3346, 3347.
Buildings and Building Materials, 3303, 3320, 3327.
Lighting, Heating, and Ventilating, 3291, 3302, 3317, 3334.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 3309, 3311, 3315, 3328.
Metals, including apparatus for their manufacture, 3293, 3305.
Chemistry and Photography, 3298.
Electrical Apparatus, 3292, 3331.
Warfare, 3297, 3300, 3304, 3326, 3335.
Letter-Press Printing—*none*.
Miscellaneous, 3295, 3312, 3314, 3318, 3322.

3291. J. Hilliar. *Improvements in ventilating, and in the exclusion of dust or draught, insects, or other animals, from apartments, carriages, or other confined spaces.* Dated December 8, 1862.

These improvements in apparatus for obtaining ventilation in buildings, apartments, carriages, beds, and other like confined spaces, whilst excluding therefrom all dust, draught, insects, or other animals, comprise the employment of rolling bands or screens of wire gauze, in one thickness or more, in manner described. *Patent completed.*

3292. E. T. Hughes. *Improvements in galvanic apparatus.* (A communication.) Dated December 8, 1862.

This invention consists of various improved arrangements of galvanic apparatus adapted to every part of the human body. When applied to the head, the patentee employs a wig-spring, and solders to one end a silvered copper plate, of any required size and shape, having a shallow cavity formed in it for containing a conductor, consisting of several folds of flannel sewed together. On the rim outside the cavity he places a ribbon of silk, and fastens it to the conductor, over which and the silk he places a zinc plate, and clasps its edge by the rim of the silvered copper plate, the said zinc plate fitting the part of the head against which it is to be placed. The two plates are insulated by the silk between them, and the double folded rim is pressed air and water tight. The same construction is applied to the other end of the spring, but the

plates are changed—that is, the plate having the cavity is formed of zinc and the plate which fits the head and covers the conductor and insulator of silvered copper plate. At the top of each cavity there are two openings, one larger than the other—the larger for the passage of the fluid for moistening the conductor, and the smaller for allowing the air to escape—which openings are to be perfectly closed when the cavity is filled. The fluid employed is vinegar or dilute sulphuric acid, either of which may contain a small quantity of weak alcohol to enable the fluid to be quickly imbibed by the conductor. When both conductors are moistened, the development of electricity is immediately perceived by the cracking noise, and when the inner plates are fitted in opposite positions against the head, the galvanic current passes through it. *Patent completed.*

3293. J. A. and C. L. Kirsling. *Improved means of renewing worn-out and partially worn-out files and rasps.* Dated December 8, 1862.

This invention consists in the judicious employment of different acids to act on the said files and rasps after they have been washed or made perfectly clean. *Patent abandoned.*

3294. J. H. Johnson. *Improvements in the construction of steam generators.* (A communication.) Dated December 8, 1862.

This invention relates more particularly to multitubular boilers or steam generators, and comprises also an improved construction and mode or method of fitting or adjusting the tubes in the tube plates, whereby greater facility is afforded for introducing, removing, and cleaning the same. The tubes, when secured in their places, according to this invention, are not contracted or obstructed by the pressure of any internal rings or ferrules, so that the cleaning of the same is more easy of execution, and the draught is impeded. The details of this invention are voluminous. *Patent completed.*

3295. T. Wingate, jun. *Improvements in dredging machinery.* Dated December 9, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3296. V. Mirland. *Improvements in manufacturing paste with the dried pulp of rhubarb to be used as preserve.* Dated December 9, 1862.

This invention consists in applying the principle of preservation by dessication to the manufacture of a paste from the petioles and fibres of fresh leaves of the plant called rheum or rhubarb, which paste the patentee terms rhubarb preserve; the said preserve, mixed with sugar or combined with aromatic essences, can be substituted for the fresh fruit in all its uses. *Patent completed.*

3297. M. F. Benton. *Improvements in the manufacture of gunpowder.* (A communication.) Dated December 9, 1862.

This invention is carried out as follows:—The first kind of powder is made from the following ingredients, in or about the following proportions; that is to say, 38 parts in weight of water, and 2 parts in weight of finely-pulverized charcoal are taken and boiled together, so that the charcoal may become dissolved. Then there are to be added 20 parts in weight of chlorate of potash, 6 parts in weight of a mixture composed of 4 parts in weight of half-calcined sea grass, and 2 parts of finely pulverized stone coal. By this addition the boiling will become interrupted, which must be restored, and then there must be added 7 parts in weight of sawdust, and the whole must be well boiled together so as to form a solution. The second kind of powder is made by taking 20 parts in weight of water and 1 part in weight of pulverized charcoal, and boiling them together until the latter is dissolved. Then there are added 10 parts in weight of chlorate of potash, and the boiling is repeated, after which there are added 5 parts in weight of half-calcined sea grass, and ¾ of a part of pulverized stone coal. The boiling which was interrupted by the latter addition is restored, and then there are added 4 parts in weight of sawdust, and the whole of the ingredients are well boiled together so as to form a solution. *Patent abandoned.*

3298. W. Clark. *Improvements in photographic apparatus.* (A communication.) Dated December 9, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3299. R. A. Brooman. *Improvements in treating liquorice root to obtain liquid and solid extracts therefrom.* (A communication.) Dated December 9, 1862.

The extracts hitherto obtained from liquorice root have been black, and when eaten have produced in the mouth a yellowish-brown saliva with a sweet, but somewhat tart, flavour. Now the object of this invention is to make the extracts, whether liquid or solid, without any apparent colour, and without the tart flavour. The invention consists in treating the root of the liquorice plant as hereafter stated. The roots are first pulverized by pestles, stones, or rollers, or they are cut up into pieces, and are washed and soaked in cold water until they are thoroughly exhausted. The resulting waters are thick and troubled; and, in order to clarify them, they are boiled, say for about ten minutes, and then strained through a woollen strainer, which retains the matters coagulated by the boiling. The liquid is then limpid, and of a dark yellow colour, and to remove this colour the liquor is placed in a filter containing animal black. The liquid, after having been acted on by the black, may be evaporated to any desired consistence, allowed to cool gradually, when it becomes a pretty firm mass, and may be made into sticks and other forms. *Patent abandoned.*

3300. G. Jeffries. *Improvements in breech-loading firearms.* Dated December 9, 1862.

This invention refers to a previous patent, dated the 2nd of January, 1862, and comprises an arrangement of parts whereby the patentee is enabled, in firearms which turn sideways, to employ a flat breech-plate at right angles to the centre line, without the inconvenience arising from an axis placed out of the centre line of the piece. *Patent completed.*

3301. J. Howard, J. Bullough, and T. Clegg. *Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.* Dated December 9, 1862.

This invention relates to the machine or apparatus generally called the opener, scutcher, or blower, and its object is to clean the cotton or fibrous material as it passes between the beater or cylinder and the dust cages more effectually than it has hitherto been accomplished. Instead of the ordinary grid bars having curved surfaces at the top, and narrow spaces between them, the inventors employ two with acute edges at the top by forming them of a triangular shape, and they place them at such distances apart as to allow the passage of the heaviest dirt or refuse. Against the under edges or surfaces of the bars they place one or more dampers or false bottoms, connected by brackets to arms or levers in contact with cams or tappets which are moved periodically so as to open the dampers for the removal of the dirt, and close them to prevent the passage of the cotton or material. *Patent abandoned.*

3302. J. M. and E. D. Sykes. *Improvements in deodorizing petroleum, shale, and other like oils.* Dated December 9, 1862.

To a quantity of petroleum, shale, or other like oils the inventors add sulphuric acid, and agitate the mixture for some time. They then add oxide of manganese, and again continue the agitation. After the mixture has been allowed to "work" for some time, and when it has settled, they draw off the pure oil, and wash it with lime water in the ordinary way, or wash it by any of the processes at present in use. The residuum in the bottom of the vessel may be added as found most convenient. *Patent abandoned.*

3303. P. Effertz. *Improvements in machinery or apparatus for making bricks, tiles, drain pipes, and other similar articles.* Dated December 9, 1862.

The nature of this invention—which is a farther improvement on a patent granted to the present patentee bearing date the 5th day of September, 1861 (No. 2211)—consists in using three or more rollers for mixing the clay or plastic material. When three only are used, he places two of them in a vertical line under one of the others. He drives the surfaces of the said rollers at different speeds, the first horizontal roller having the lowest speed, and the bottom one the greatest. The variations of speed may be obtained by making the rollers of different diameters, or by giving each of them a different number of revolutions per minute, or by both means combined. He also leaves a greater space between the two horizontal rollers than between the second horizontal roller and the bottom roller, and causes the rollers to revolve in opposite directions. The said rollers run in bearings fixed on framework, and between two side plates, forming a channel provided with scrapers or doctors to clear the adhering clay from the rollers. The clay or material is forced into the channel by the rollers, and the side plates are provided with a die or shaper through which the clay or material is forced in the desired shape. *Patent completed.*

3304. W. E. Newton. *Improvements in firearms.* (A communication.) Dated December 9, 1862.

This invention has for its object to simplify the construction of firearms, by reducing the number of separate pieces of which the arm is to be composed. This object is effected by constructing the separate parts in such a manner as to cause each single piece to perform the offices of two, three, or more of such pieces as are used in ordinary firearms to effect the desired object. For instance, in an ordinary musket, the lock (including the two screws for securing it to the stock) is composed of fourteen pieces, whereas the lock which forms the subject of the present invention is composed of only three principal parts—viz., the hammer, the lock-plate, and the spring. The screw of the lock-plate is made to serve also to secure the lock to the stock, and for holding the hammer. The spring is provided with a stud which fits in a hole in the lock plate, and is thereby held in place, and at tension. The outer end of the spring has two notches made in it, for the purpose of receiving a cam piece, which is fixed on the inside of the hammer. The other end of the spring also acts on the hammer, which is relieved by means of the trigger from the notches at the first-mentioned end of the spring. *Patent completed.*

3305. E. B. Wilson. *Improvements in machinery or apparatus for rolling metals.* Dated December 9, 1862.

This invention relates to a peculiar construction and arrangement of conical rolling mill, and consists in driving one roll direct from the main shaft by a pair of bevel wheels, another pair of bevel wheels being also employed for driving the other roll direct from the first roll; one of the rolls is adjusted either by the aid of a cam or hydraulic power. The framing of the rolling mill is of course peculiarly adapted to suit this arrangement, either vertically or horizontally. *Patent abandoned.*

3306. J. Lamb. *Improvements in the manufacture of tissue paper for transferring patterns and designs.* Dated December 10, 1862.

This invention consists in combining the size with the pulp in the ordinary rag engines or other machinery now employed in preparing the pulp for the paper-making machines, or in combining the size with the water with which the pulp is diluted previous to, or when it is supplied to, the paper-making machines, or in sizing the paper in its progress through the paper-making machine. *Patent abandoned.*

3307. W. Inglis. *Improvements in steam boilers.* Dated December 10, 1862.

This invention relates to improvements in steam boilers designed more particularly for generating steam of moderate pressure, and consists, generally, in constructing the boiler with a high furnace, combined with a down draught, and an arrangement of parts whereby the water in the boiler is made to circulate rapidly, and in a direction opposite to the course of the furnace gases. This invention cannot be described without reference to the drawings. *Patent completed.*

3308. L. A. Lesage. *Making and moulding fruit, jellies, and preserves.* Dated December 10, 1862.

This invention consists in solidifying fruit, jellies, and jams, by means of apple juice, in moulds. The inventor prefers using the juice of the apple called in French the pigeonnet, although other kinds will answer the purpose. The jellies and jams thus made cannot be differently coloured and perfumed with the required aroma, and are made in moulds of any suitable material, which may have separations, in order that the same jelly may receive different flavours and colours. *Patent abandoned.*

3309. J. R. C. Taunton. *Improvements in the manufacture and ornamentation of metallic bedsteads and other articles of like manufacture.* Dated December 10, 1862.

This invention consists—1, in manufacturing the pillars of metallic bedsteads and other articles of like manufacture by casting the said pillars of malleable cast iron, or of brass, in the following manner:—The inventor casts the pillar and corner block (without the dovetail socket) and the leg all in one piece, the casting being hollow or tubular. He effects the casting in sand wholly cored with a sand or loam core, as ordinarily employed in making hollow castings. The ends of the pillar and leg may either be cast opened or closed. When they are cast open at the ends, the said ends are provided with top and bottom mounts, which may either be cast on the said ends by means of chills or iron moulds, or cast separately in sand or chills, and afterwards fastened on the ends. The dovetail socket of the corner block is cast in the following manner:—He makes hollows in or projections on the corner block, the said projections having heads, and the said hollows being of such a figure, that metal cast in them will be fixed therein. Over these hollows or projections, he places chills or iron moulds, having internally the figure of the dovetail socket of the joint. Into the said mould he runs molten iron, and thereby casts upon the corner block the dovetail socket required to affix the side of the bedstead to the pillar, the said dovetail socket being secured to the corner block by being cast upon the projection on, or engaging in, the hollow or recess in the corner block. This invention consists—2, in ornamenting metallic bedsteads and other articles of like manufacture in the following way:—He casts ornaments of iron, brass, or other metal on the outside of the angle iron or other frame of the bedstead or other article, or on any other part of the bedstead or article which it may be wished to ornament. At the parts where the ornaments are to be cast, he rivets or screws rivets or screws having heads; or he makes a hole or holes at those parts. When the ornaments are cast upon those parts, they are fixed by being cast upon the heads of the rivets or screws, or by a part of the molten iron running through the holes, and forming heads on the side of the frame opposite to that which is ornamented. When the ornament is attached by means of the holes described, chills or moulds are placed on either side of the place where the casting is effected, so as to form the ornament on one side and the head on the other. *Patent abandoned.*

3310. S. B. Whitfield. *Improvements in the dovetail joints used in metallic bedsteads and other articles of like manufacture.* Dated December 10, 1862.

This invention consists in making the taper-piece, or "he-dovetail" of the said dovetail joint, either of ordinary wrought iron or of the annealed cast iron called malleable iron. In making the said "he-dovetails" of wrought iron, the patentee shapes them by the stamping or forging process, and in making them of annealed cast iron, he casts and anneals them in the ordinary way. In either case he makes a connecting-piece on the said "he-dovetail," by which to connect it to the block of the joint. The said connecting-piece may either be of a conical figure, its axis being parallel to that of the "he-dovetail," by tapering in an opposite direction; or it may be of an angular or other figure. The "he-dovetail" of wrought or malleable iron may be connected to the cast-iron block on the end of the rail by the said block being cast on the end of the rail, and on the connecting-piece of the "he-dovetail" at the same time. Or the said block may have a recess cast in it into which the connecting-piece of the "he-dovetail" may be placed and fixed. *Patent completed.*

3311. M. Osborne. *Improvements in the manufacture of cast-iron fenders.* Dated December 10, 1862.

This invention consists in certain improvements whereby the fronts of cast-iron fenders are cast upon the ends of the fenders, so as to secure the ends to the fronts, by which improvements the fastenings ordinarily employed to connect the ends and fronts of the fenders together are superseded. *Patent completed.*

3312. A. P. Price. *Improvements in the manufacture or production of colours.* (A communication.) Dated December 10, 1862.

This invention has for its object the preparation of blue colours which are obtained as follows:—The inventor takes a compound or combination of aniline, consisting of aniline combined in equivalent proportions with any of the following acids, namely—acetic, valerianic, lactic, benzonic, cinnamic, tartaric, and oxalic acid, such compounds being either obtained by, or resulting from, direct combination of equivalent proportions of acid and aniline, or obtained by means of, or resulting from, double chemical decomposition, as is well understood by chemists. He mixes any one of these compounds or combinations so resulting or obtained, or mixtures of them, with the substance known in Germany and France as fuchsine, and corresponding with those products obtained from aniline known in this country as magenta and roseaniline, and he heats the same together by preference at a temperature of from 160 deg. to 190 deg. centigrade, until the desired blue colour free from violet is produced. *Patent completed.*

3313. D. Chalmers. *Improvements in the preparation or manufacture of textile materials, and in the machinery or apparatus used therein.* Dated December 10, 1862.

This invention relates to the arrangement and construction of winding, copping, or balling machines, such as are used in the manufacture of flax and other textile materials, as well as to the shuttles employed in weaving. In the im-

proved winding machine, the winding or balling spindles are disposed in an angular, diagonal, or horizontal position, or they are inverted for the purpose of taking advantage of the weight of the spindle for hardening the cop or pin. The object of the diagonal or horizonral spindle arrangement is to enable the attendant to doff or take off the cop with greater ease. The spindles each work through a tube and stuffiing box, so as to throw the desired friction or weight upon the spindle, and thus dispense with the use of levers or weights. *Patent completed.*

3314. W. A. Turner. *Improvements in machinery for cutting and paring starch.* Dated December 10, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3315. W. Clark. *Improvements in umbrellas.* (A communication.) Dated December 10, 1862.

This invention relates to an improved umbrella and cane combined, according to which an umbrella may be applied to or separated from an ordinary walking stick, which can be used alone, as usual. The principal features of this invention are—1, the handle or stick of the umbrella has no openings or slits made in it for applying spring catches, which are dispensed with, and the stick is for this reason much stronger and of simpler and readier construction than the ordinary stick; 2, the umbrella can never be turned inside out by the wind; 3, it opens without difficulty by means of a peculiar arrangement of the ribs. An improved mechanical arrangement is also applied for securing the umbrella in a closed position, as also for reducing its length one half without rendering it inconvenient. The invention cannot be described without reference to the drawings. *Patent completed.*

3316. J. King. *Improvements in apparatus used for signalling on railways.* Dated December 10, 1862.

For the purpose of this invention, at intervals along a line of railway, telegraphing stations are erected containing ordinary clock-work, capable of rotating a pointing instrument, suitable when brought into position to be acted upon by the clock-work, and thus to indicate to the driver of the next train within what period (within a given time) the preceding train has passed the station. *Patent completed.*

3317. E. Toynbee. *Improvements in extracting oils and fatty matters from shoddy or refuse wool, skins, or skin pieces, glue pieces, cotton waste, and other animal or vegetable matter, and in producing an artificial manure.* Dated December 10, 1862.

Here the fibres or substances are boiled in sulphuric acid until the whole dissolution of the fibre is effected. Steam is then admitted into the vessel to cause the oils to rise to the surface, from whence they are collected for distillation. During the distillation properly prepared phosphates are added; the liquid compound is now run off into a drying material, either organic or inorganic, and a highly nitrogenized and phosphatic compound is obtained, and which forms a valuable manure. *Patent completed.*

3318. J. Speight. *Improvements in horse-hoes.* Dated December 11, 1862.

This invention relates to improvements upon a patent granted to the present patentee on the 29th day of March, 1859, No. 786, for "improvements in horse-hoes," and refers particularly to a method of regulating the depth at which the hoes work when used on uneven ground, such as hill sides, or on ridge land. In the former specification the hoes were described as being attached to levers connected with a revolving shaft working in a slide frame having bearings at each end, and which shaft could be raised or lowered as required for different kinds of corn or roots. The present improvement consists in suspending the shaft or bar to which the hoes are attached upon a bearing at its centre, instead of at each end, so that when one end is raised by turning a handle or otherwise, as described in the former specification, the other end is lowered in a corresponding degree, and thus when working over ridged or curved surfaces, or along what are called "lands," the depth or bite of the hoes may be regulated by the attendant with the greatest nicety. *Patent completed.*

3319. W. Tristram and H. Brereton. *Improvements in machinery or apparatus for sizing yarns and threads.* Dated December 11, 1862.

These improvements are applicable to the machines known in the trade as "slashers" and tape machines, which machines are employed for sizing and drying yarns and threads, and winding them on to beams. The invention consists in the application of a revolving brush which acts on the yarn or thread immediately after the yarn or thread has passed the rollers by which the size is applied, and by which the surplus size is squeezed out; the brush rotates rapidly, and the yarn or thread is pressed into the bristles by means of a rod connected to a swing frame, the position of which can be varied so as to increase or reduce the depth to which the yarn is pressed into the bristles. Below the revolving brush is another brush which revolves slowly in a trough containg soap and water, or other liquid for clearing the brush acting on the yarn or thread, and keeping it moist. *Patent completed.*

3320. J. R. Breckon and T. Douglas. *Improvements in the manufacture of fire-bricks and other articles usually made from fire-clay.* Dated December 11, 1862.

This invention consists in making fire-bricks, and other articles usually made from fire-clay, of the fire-stone called Ganister, as it is found in the coal fields in the counties of Durham and Northumberland, combined with the ordinary fire-clay, as they are obtained from the coal measures of the two aforesaid counties. *Patent completed.*

3321. R. A. Ronald. *Improvements in printing textile and felted fabrics, and in the machinery or apparatus to be used therein.* Dated December 11, 1862.

The patentee claims—1, The system or mode described of arranging and constructing the printing machinery with internal beaming roller, or any mere equivalent therefor, to admit of the felted or woven fabric being printed in pieces or continuous lengths, or in squares, by being wound on to and off these rollers as each printing operation of the exposed surface is completed. 2, The system or mode described of relieving the frictional contact of the cloth with the printing drum by means of rollers inserted beneath the cloth, or between it and the drum, so as to admit of heavy fabrics being printed in pieces, or lengths or in squares; also the mode described of keeping the edges of the cloth clear of the tenter hooks by means of cords carried round the printing drum. 3, The printing of felted or woven fabrics suitable for carpeting, druggets, crumb cloths, rugs, flannels, baizes, or other generally similar fabrics, in the manner and by the means described. *Patent completed.*

3322. R. Clark. *Improvements in machinery or apparatus for boring, winding, and lifting for mining purposes.* Dated December 11, 1862.

This invention relates to certain mechanical arrangements for effecting the several operations of boring, winding, and lifting, as connected with mining operations, in a more expeditious, effective, and economical manner than has heretofore been accomplished. Under one preferable modification, the machinery or apparatus consists of an open rectangular framing, built low to ensure stability. This framing carries one or more horizontal steam cylinders, which actuate a first motion horizontal crank shaft set in bearings on the framing. This first motion shaft has fixed upon it a spur pinion, which gears with a large spur wheel on a second motion horizontal shaft, also carried in bearings upon the main stationary framing. The first motion shaft, in addition to the spur pinion, carries a lever arm or cam piece arranged to work upon a vertical connecting rod, which is connected to one end of the main boring lever. This main lever is set upon a fixed overhead centre, carried by the framing; and to the other end of it is jointed or suspended the boring bar, which thus receives an up-and-down boring motion. The pedestal or journal carrying this lever is adjustable laterally, so that the parts can be set clear away from the line of bore, whenever access is required for cleaning or other purposes. The vertical connecting rod is fitted with a collar or shoulder piece for the support of counter weights, to be added as may be necessary for counterpoising the weight of the boring bars and appurtenances. To the lower end of this connecting rod, there is also jointed a horizontal connecting rod, the opposite end of which is jointed or linked to a crank or lever arm, set on a horizontal shaft carried by the framing, and which shaft also carries another short lever with a nut for being worked by a screw spindle. By turning this screw spindle, the catch of the vertical connecting rod can be set in or out from the path of the operating cam or lever upon the first motion shaft; and thus the stroke of the boring apparatus can be regulated or adjusted with the greatest nicety, or can be entirely disengaged from the operating cam. The second motion shaft, also, has upon it two winding barrels for the ordinary winding purposes of the mine, and for raising and lowering the pumps and boring rods. Both these barrels are fitted with conical or other-shaped frictional clutches, for engagement and disengagement at pleasure. *Patent completed.*

3323. A. W. Burgess. *Improvements in the preparation of anchovies.* Dated December 11, 1862.

This invention relates to improvements on the subject matter of letters patent granted to Elizabeth Burgess Burgess, for "improvements in the preparation of anchovies," dated November 12, 1859, No. 2573, and consists in preparing anchovies with butter in such a manner as to eradicate all extraneous matter, to preserve and improve the flavour of the fish, and to impart to the butter the delicate flavour of the anchovy, without detriment to the fish itself. *Patent completed.*

3324. J. Imray. *Improvements in apparatus used for mixing and kneading.* Dated December 11, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3325. W. Goulding. *Improvements in ploughs.* Dated December 11, 1862.

For the purposes of this invention, the land side of the body of a plough, in place of being upright, or as nearly so as may be, in respect to the sole of a plough, is formed in such manner as to incline from the sole over towards the furrow side of the plough; and the beam, when it is fastened to the body, in place of being directly over the land edge of the sole, comes more over towards the furrow side edge of the sole of a plough, by which the plough will be in a better state of balance and equilibrium than heretofore. *Patent completed.*

3326. T. E. Vickers. *Improvements in the construction of ordnance.* Dated December 11, 1862.

The object of this invention is to cool the block of metal in such a manner as to cause that portion of its section which is nearest to the inside of the bore to contract first, the other portions of the sections being allowed to cool upon it in the order of their respective distances from the axis of the piece. *Patent completed.*

3327. G. Winiwartar. *Improvements in the construction of portable houses, walls, or partitions of buildings, strong-rooms, safes, refrigeratories, reservoirs, piers, and other structures; also applicable to the construction of casks and similar articles, boats, and ships.* Dated December 12, 1862.

This invention consists in constructing walls or surfaces of any description, or to be employed for any purpose, by placing metal tubes bound round with straw, or other similar material, and steeped in clay, mortar, or cement, one on top or by the side of the other, between grooved posts, girders, or other supports, in the grooves of which the ends of the tubes are confined, forming thus a strong air-tight surface, which is a bad conductor of heat, and which has the advantage over ordinary wood, stone, or brick walls of being considerably stronger than these, whilst it has a much less bulk or thickness. *Patent abandoned.*

3328. H. Sanderson. *Improvements in the manufacture of table and other knives and forks.* Dated December 12, 1862.

This invention applies to the method of securing or fixing the bolster to the tang and blade. Hitherto the bolster has been usually made of one piece with the tang and blade by raising it by the hammer when hot, but, according to the present invention, it is a separate piece, and is joined to the blade by contraction after heating. The tang and bolster are made of the same metal, and the blade is fixed thereto in the following manner:—A hole being formed in the bolster of a suitable form and size for the insertion of the end of the blade, the bolster is to be expanded by being heated, and the end of the blade being placed in the hole of the bolster, the latter is allowed to cool, and consequently contract or shrink on to the blade, thereby making a firm joint, which cannot be loosened by any ordinary means. *Patent abandoned.*

3329. J. E. Roussel. *Improvements in hand and power looms for weaving.* (A communication.) Dated December 12, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3330. J. Gaskell and H. Walmsley. *Improvements in regulating the tension of yarn in the processes of warping, winding, sizing, weaving, and other similar purposes.* Dated December 12, 1862.

This invention consists in regulating the tension of the yarn by giving motion to the bobbins or other apparatus on which the yarn is wound. For this purpose the patentees put a loose or fast spindle into the bobbin or bobbins, and give motion to the said spindle or shaft by a wharve, wheels, or pulley, in connection with the moving power by a band or other suitable means, and thus obtain the required motion; or, if found desirable, the wharve or pulley may be turned on the bobbin head instead of being separate. Or they use a friction roller on which the bobbin or bobbins rest for the same purpose, this latter plan being more especially applicable to winding, sizing, and weaving processes. They place the shaft or bobbin in a vertical, horizontal, or diagonal position, as may be found most desirable. *Patent completed.*

3331. O. Hancock and S. W. Silver. *Certain compounds and substances applicable for electric insulation and other purposes.* Dated December 12, 1862.

In carrying out this invention, the patentees propose to combine caoutchouc with a milk or gum, the produce of a tree called Sapota Mulieri or bullet tree, which is found in British Guiana, and to which the term Ballata has been occasionally applied. This milk or gum possesses similar insulating properties to caoutchouc. They combine caoutchouc and ballata by mastication, rolling, or solution, according to one of the several processes well known among india-rubber and gutta-percha manufacturers. *Patent completed.*

3332. A. Mills. *Reefing and unreefing, furling and unfurling sails of ships and other vessels, and an improvement in the rotary yards and the journals in which the sockets or ends of the rotary yards work.* Dated December 12, 1862.

With reference to the reefing and unreefing, furling and unfurling of sails, this invention consists in making holes in the sails, which are worked on rotary yards or rollers; there is a hoop fitted on the rotary yard or roller, in which hoop is fixed a hook, which, as the yard revolves, catches a pall or shackle fitted on a hoop on the other or fixed yard. As the yard revolves, the hook before mentioned leaves the shackle and goes through the holes in the sail, which are disposed at such distances as that the hook will go through one hole at each revolution of the yard, until the sail is completely reefed, furled, or stowed. In unreefing or unfurling, a line attached to the end of the pall raises the pall from the hook until the sail is set, then, by slacking the line, the pall attaches to the hook again. As to the journals in which the sockets or ends of the rotary yards work, this invention consists in an application to the journals of an iron stay or stays by which the strength and bearing power of both yards is materially increased; the panel or sliding piece is improved by the addition on the aft side of it of a down-haul; the rotary yard or roller is strengthened by a cross iron let into it all through, the yard being divided into two or four pieces for the purpose of receiving the iron. *Patent abandoned.*

3333. G. Clark. *Improvements in fortification for the defence of ships, batteries, and forts.* Dated December 12, 1862.

The first part of this invention comprises a system of defensive armour composed of a combination of plates or sheets of iron or other metal with plates or sheets of tough material of less specific gravity than iron, alternating with each other, and closely compressed and fastened together side by side, forming a compact body calculated to resist the penetrating force of projectiles by exposing to it either the edges or the flat surface of a mass of combined plates. The second part of this invention refers to through-bolts, and is for the purpose of counteracting the tendency of a conical bolt-head when struck by a projectile to act as a wedge and spilt the armour plate. The inventor effects this object by means of a tubular sheath with a conical bore placed under the hole in the armour plate, through which sheath the bolt passes and rests upon the shoulder formed by the conical bore of the sheath, diminishing from the outside, the bolt being tapered to fit in the conical bore of the sheath. *Patent abandoned.*

3334. S. Fox. *Improvements in retorts and apparatus employed for the manufacture of gas, and also in purifying gas.* Dated December 12, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

3335. J. Brown. *Improvements in the manufacture of armour plates.* Dated December 13, 1862.

The object of this invention is to give a curved edge to armour plates with the same facility as a straight edge is now given. Upon the bed of an ordinary planing machine a series of brackets are bolted at intervals; these brackets are to hold a stout bar of iron or steel, and are furnished

in their jaws with set screws, by means of which the bar can be forced to assume any curve required. When the bar has been bent by the pressure of the screws into the desired curve, the upper edge of the bar is made to serve as a guide to force the tool-box of the planing machine either to the right or to the left, gradually, as the table moves, and the plate on the machine has its edge pared or cut down exactly in conformity with the curve given to the guide-bar. The amount of curvature in the guide-bar determines and governs the lateral travel of the tool-box. *Patent abandoned.*

3336. J. W. BAKER. *Improvements in machinery or apparatus for spinning cotton and other fibrous materials.* Dated December 13, 1862.

This invention relates to hand and self-acting mules, and consists in giving a positive motion to the tin roller which drives the spindle by means of toothed gearing. The rim shaft of the mule is connected by toothed gearing or otherwise to an elongated toothed spur wheel of rather greater length than the draw of the carriage, so that as the carriage moves backwards and forwards a spur wheel in the carriage remains constantly in gear with the said elongated toothed spur wheel. The spur wheel in the carriage is connected by suitable gear to the tin roller shaft, and thereby drives the spindle by positive gearing, instead of the present mode of driving by hand. *Patent completed.*

3337. J. BROWN. *Improvements in hydraulic machinery.* Dated December 13, 1862.

This invention consists of a box containing a piston for the prevention of accidents in hydraulic machinery in the event of the main pressure-pipe breaking or engine stopping. This box the patentee places above the relief valve now in use, connecting the said box by means of a pipe to the lifting cylinder or cylinders. In the event of the main pressure-pipe breaking, or engine stopping, as aforesaid, the pressure contained in the lifting cylinder or cylinders will at once act on the piston and cause the rod thereof to press upon the relief valve, thereby preventing the water escaping from the lifting cylinder or cylinders, and thus stop the running down of any weight the machinery may be lifting. The box and piston may be fixed at any convenient place instead of above the relief valve now in use, but in such cases he fixes to the piston rod a mitre stop valve or clack, which will act on the seat of the piston box and have the effect as above described; or he connects the said piston rod with the existing relief valve. *Patent completed.*

3338. E. THOROLD. *Improvements in drill braces, which improvements are also applicable to spanners.* Dated December 13, 1862.

This invention consists in substituting for the usual ratchet-wheel and pawl used in ordinary hand drilling machines (commonly termed ratchet-braces) a cylindrical wheel or barrel forming or being the body or part of the body of the drill brace, the circumference of which may be of any desired form—viz., either plain, convex, or concave, or may present a succession of flat, convex, concave, or other suitably formed surfaces, the form of the end of handle varying accordingly. The handle or lever of the drill brace is held in such a position by any suitable and convenient means by a guide or guides, so that when moved to and fro in the usual manner the short end of the handle or lever comes in contact with the wheel barrel or body of the drill brace, and may be pressed so hard thereon as to enable the user to communicate the usual rotary motion to the drill brace, but thus doing away with the usual ratchet of ordinary ratchet braces. *Patent completed.*

3339. C. CORBET. *Improvements in rails for railways, and in the mode of forming the joints of the same.* Dated December 13, 1862.

This invention relates to a new form of rail and combined chair and fish to be used therewith for forming the junction of the rails, and consists in the use of a bridge-rail made wider at its upper part or head than at the lower part above the base, the sides being curved inwards at such parts, and then curving outwards to form the base. Into the hollow of this peculiar rail there is fitted accurately a correspondingly shaped chair, or chair and fish combined, which enters some little distance into such end of the rail, the peculiar shape of which prevents all chance of lateral or vertical motion at the joint. It is further proposed to form the chair, or chair and fish, with a base plate having raised ribs at each side, for the purpose of preventing any expansion of the base of the rail, the edges of the flanges of which abut against the raised ribs above mentioned. When used between the sleepers the rail is bolted down upon the base plate of the fish, or chair and fish, by special bolts with washers; but when used upon a sleeper, the two bolts and washers, which fasten down the chair, or chair and fish, to the sleeper only need be employed. In all cases bolts are used, the nuts or heads of which project partly over the flange of the rail, and so effectually prevent all tendency to rise from the chair, or chair and fish. That portion of the chair which acts as the internal fish may, if desired, be bolted into one rail, and merely slipped into the end of the other. Iron plates will be used under the rail on every sleeper, or on every second or third sleeper, as desired, in order to give bearing surface to the rail, and to prevent it from sinking into the timber. These plates will be made wider than the flange of the rail, and have holes in the centre to take a spike or bolt with a washer of peculiar shape made to take the flange of the rail and the head of the bolt. *Patent completed.*

3340. R. AITKEN. *Improvements in locomotive engines.* Dated December 13, 1862.

This invention relates to a peculiar system or mode of actuating the driving wheels of locomotive engines, with a view to the prevention of the great oscillation which occurs when using outside cylinders. According to this invention, it is proposed to transmit the power of both pistons to the centre of the driving axle, in place of to each driving wheel separately. For this purpose a hollow driving axle is used through which passes a straight driving shaft, having a single crank fitted thereon at each extremity outside the wheels. This driving shaft is coupled in any convenient manner with the hollow axle at a point central or nearly central with the length of the axle, and is supported near its extremities by a bush in the axle, or by collars forged or otherwise formed or fitted upon the driving shaft or on the interior of the hollow axle. *Patent abandoned.*

3341. J. PETRIE. *Improvements in machinery or apparatus for washing wool and other fibrous materials.* Dated December 13, 1862.

This invention relates to that construction of machine for washing for which letters patent were granted to John Petrie, jun., and Samuel Taylor, dated 11th January, 1853, No. 75, and consists in a method of driving the endless apron. For this purpose the inventor provides the said apron with a series of teeth or projections, in gear with which is a toothed roller, situate between the two end rollers, and these end rollers, therefore, he can use of a smaller diameter than would be necessary if they were the drivers. The above mentioned toothed roller may be in gear with the apron on the upper and lower sides thereof, or on one side only. *Patent abandoned.*

3342. J. J. THOMPSON. *Improvements in machinery or apparatus for making pies and for cutting meat for the same.* Dated December 13, 1862.

According to this invention, the inventor employs moulds of the desired shape of the pie, which moulds are placed in a press or similar apparatus. Into these moulds the paste is placed, and rams are then pressed into it to form the hollow crust. The rams are then removed, and the meat filled in, after which the top crust of the pie is applied, and another mould descending effects the required pressure to cause it to adhere, and to impart any pattern required. He proposes making the moulds and also the rams in two or more pieces, so as to part and thus admit of shapes being produced which would not otherwise leave them. The moulded pies are removed by the aforesaid parting of the moulds, or are thrust upward or downward. In cutting meat for pies he employs a series of revolving blades, the edges of which are situate within a grooved spindle; or he employs two series of revolving blades, the one extending within the spaces of the other. *Patent abandoned.*

3343. W. E. NEWTON. *An improved mode of and apparatus for repairing the rails, points, switches, and other parts of the permanent way of railways.* (A communication.) Dated December 12, 1862.

The object of this invention is to mend or repair the damaged portion of the rail, and render it serviceable without being obliged to resort to re-rolling, or re-manufacturing the whole rail. To this end the inventor cuts off or removes the surface of the damaged part of the rail, and he welds on to this part a flat piece of iron or steel of suitable width and thickness, the operation being performed in such a manner as to form a perfectly level surface from end to end of the rail. As the welding operation requires a high degree of heat, and as the web of the rail is thinner than the tread, the web is liable to be knocked out of shape during the welding process above-mentioned. To obviate this, he supports the rail during the welding process in a pair of moveable jaws, which will be made to clasp the web firmly and support the under side of the tread. These jaws may be worked either by a lever or by a screw like a vice. *Patent abandoned.*

3344. M. HENRY. *Improvements in fitting or applying propellers to ships and other vessels.* (A communication.) Dated December 13, 1862.

The object of this invention is to fit or apply propellers to ships and other vessels in such manner that the position of the propeller or direction of its axis with respect to the ship or vessel may be varied, so that the propeller may be turned or worked like a rudder, or its axis placed at various angles to the direction of the fore-and-aft line of the vessel. Another object of the invention is to fit propellers in such manner that they may be raised and lowered bodily, and thereby more or less submerged. By the arrangements herein described, a vessel may be brought round in a small circle, and perform other evolutions with ease and safety. *Patent completed.*

3345. M. J. ROBERTS. *Improvements in means and apparatus for preparing and spinning wool, cotton, and other fibrous substances.* Dated December 15, 1862.

This invention was described and illustrated at page 475 of the present volume of this journal. *Patent completed.*

3346. W. BESTWICK. *Improvements in braiding machines.* Dated December 15, 1862.

Instead of the revolving cams at the top of the machine, for giving tension to the yarns or threads, the inventor employs two or more horizontal combs connected to the rings of eccentrics, or to cranks, so that the combs may have an eccentric to-and-fro motion upon the yarns or threads, and maintain their tension effectually, without any danger of entanglement or breakage. These improved combs are to be applied to all sizes and descriptions of braiding machines. *Patent abandoned.*

3347. R. STANSFIELD and J. DODGEON. *Improvements in looms for weaving.* Dated December 15, 1862.

This invention consists—1, in an improved stopping motion for stopping the loom when the shuttle is not in the box. The inventors employ in each shuttle-box that description of swell which is acted upon by the top of the shuttle, but bring the end of the swell to the back of the box, so that, when the swell is held up by the shuttle, its end shall come in contact with a lever on the stop rod, and hold up the stop rod finger; but when the shuttle is not in the box, the end of the swell shall not be in contact with the lever, and thereby allow the stop rod finger to be depressed, and come in contact with the frog and stop the loom. They also employ the check strap for stopping the loom when the shuttle is not in the box. They connect the strap at two places in opposite positions to a boss or pulley working on a stud at the front of the slay, so that when the shuttle acts against the strap end in either shuttle-box, the boss shall be turned in the same direction. The boss is attached by part of the check strap or other connection to a lever on the stop rod, or to the stop rod finger itself, in such a manner that, when the shuttle is properly boxed and strikes the end of the check strap, it raises the stop rod finger out of contact with the frog; but, when the shuttle does not arrive in the box, the check strap is not pulled, and the finger not being raised comes in contact with the frog, and stops the loom. 2, in an improved arrangement of buffer or check strap. They coil one end of the strap round a concentric or eccentric boss fixed to the slay or lathe, instead of fixing to it the end of the strap itself, by which means there is greater elasticity and prevention of wear and tear than in any other method; and 3, in an improved mode of stopping the loom when the weft thread breaks, and when there is no weft. *Patent abandoned.*

3348. G. BUCHANAN. *Improvements in machinery used in crushing sugar canes.* Dated December 15, 1862.

In carrying out this invention, the patentee combines an oscillating steam engine with the crank or driving shaft on which the fly wheel is fixed, and with the crushing rollers, in such manner that the oscillating engine is placed between the fly wheel and the crushing rollers, and the fly wheel is caused to be beyond the end of the bed or base-plate, and it descends partly below the end of such plate. By thus combining the machinery, the position of the crank or driving shaft of the engine, and the framing which supports the same, are considerably reduced in height from the base or bed-plate, and the arrangement of the machinery is generally improved. For these purposes, the oscillating steam engine is placed between the fly wheel and the large cogged wheel, which is, by preference, furnished with internal teeth, but this is not essential. The crank or driving shaft turns in bearings on a suitable framing between the engine and the fly wheel, and the crank or driving shaft by a pinion thereon communicates motion to a cog wheel on a shaft which has fixed on it a pinion which takes into and drives the large cog wheel which gives motion to the crushing rollers as heretofore. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated March 21, 1863.

758. J. M. Hetherington, Manchester, machine maker. Improvements in machinery or apparatus for combing cotton and other fibrous materials.

Dated May 28, 1863.

1335. F. R. Piltz, Frederick-street, Hampstead-road. Improvements in the mode of producing ornamental surfaces, applicable to the general purposes of decoration.

Dated May 30, 1863.

1357. E. T. Hughes, 123, Chancery-lane. Improvements in apparatus for the transmission of motive power. (A communication.)

Dated June 4, 1863.

1395. M. V. L. De Wailly, Paris. An improved method of preserving carpets from the effect of dust.

Dated June 8, 1863.

1411. J. Hogg, jun., 49, Fleet-street. Improvements in the manufacture of show cards.

Dated June 11, 1863.

1454. C. L. V. Tenac, Tredegar, Monmouthshire, South Wales, civil engineer. An improvement in railway wooden sleepers. (A communication.)

Dated June 13, 1863.

1484. A. Méhu, Petit Talard, near the town of Saint Malo, France, mechanical smith. An improved helm for working the rudders of ships or vessels.

Dated June 15, 1863.

1492. J. Forrester, Burslem, Stafford. Improvements in the manufacture of bricks, quarries, slabs, tiles, earthenware pipes, and other earthenware or ceramic articles.

Dated June 16, 1863.

1502. F. S. Williams, Boston, United States. An improved apparatus for shaping plastic materials and hot but not melted metals by means of pressure, percussion, or rolling. (A communication.)

1508. J. Steele and W. Mason, Leeds, corn factor. Improvements in apparatus for removing the bran or outer skin from wheat and other grain.

Dated June 17, 1863.

1518. W. Crofts, New Lenton, near Nottingham, manufacturer. Improvements in the production of fabrics by lace machinery, and in means or apparatus employed therein.

Dated June 18, 1863.

1526. W. S. Lowe, Disley, Chester, and J. Cheetham, Oldham. Improvements in self-acting mules for spinning cotton and other fibrous materials.

Dated June 19, 1863.

1534. S. Middleton, Newtown-cottage, Hants, near Newbury, mechanic. Improvements in the manufacture of iron or other metal shoes, and in the method of securing the same to the hoofs of horses and other animals without nails.

Dated June 20, 1863.

1548. P. Fassio, residing at No. 1, Rue des Orangers, Nismes, France. A new method of connecting several fire-places with one chimney.

1560. J. Booth, Halifax. Improvements in winding machines.

Dated June 24, 1863.

1590. T. Redwood, Summerfield Works, Lower Homerton. Improved apparatus for straining or for mixing and straining liquid and solid substances.

Dated June 25, 1863.

1600. T. Page, Adelphi-terrace. Improvements in horse shoes and in their fastenings.

1602. R. Mushet, Coleford, metallurgist. Improvements in the manufacture of iron and steel.

1604. H. G. Craig, Passage West, Cork, shipbuilder. Improvements in machinery for manufacturing or paring iron and other metal plates for shipbuilding or other purposes.

1606. A. Watson, King-street, city, engineer. An improved fastening.

Dated June 26, 1863.

1608. A. Tulpin, Manchester, engineer. Improvements in machinery for stretching and drying fabrics. (A communication.)

1610. G. Boccius, Henrietta-street, naturalist. An improved composition suitable for the manufacture of candles and other like articles, and of pomatum, and an improved wick for burning with such composition.

1612. J. Griffiths, Derby, manager of iron works. Improvements in machinery for puddling iron and steel.

Dated June 27, 1863.

1616. W. and J. Bradshaw, Blackburn. Improvements in looms for weaving.

1618. J. Chatterton, Highbury, engineer. Improvements in lining iron and other tubes and hollow vessels, and in manufacturing corrugated tubes of plastic materials.

Dated May 29, 1863.

1620. W. Andrews, 237, Gresham-house, Old Broad-street. Improvements in apparatus for insulating electric telegraph wires.

1622. L. E. Hicks, New York. An improvement in inkstands.

Dated June 30, 1863.

1624. L. F. A. B. Marulaz, Guéret Creuse, France, commissary-general, Officer of the Legion of Honour, and Knight of the Order of Leopold of Belgium. Improvements in the manufacture of combs.

1626. J. Simpson, Darlaston, bolt and iron hurdle and fencing manufacturer. Certain improvements in iron hurdles and fencing.

1628. A. K. Richards, Berners-street, Oxford-street. Improvements in ordnance and firearms, and in projectiles to be used therewith.

1630. A. Silvester, Clapham-road, photographer. Improvements in apparatus to be used in the exhibition of dramatic and other like performances.

Dated July 1, 1862.

1634. T. Alliston, 237, Euston-road, iron bedstead maker, and R. Swift, 2, Hardy-terrace, Hounslow, civil engineer. An improved mode of and apparatus for manufacturing metallic joints for bedsteads, and the application of such joints to certain parts of bedsteads.

1638. R. C. Clapham, Walker, Northumberland, analytical chemist. Improvements in the manufacture of hyposulphite of soda, sulphite of soda, and sulphite of lime.

1640. J. and J. S. Harvey, Hanover-square, Newcastle-on-Tyne, tobacco manufacturers. Improvements in machinery for cutting tobacco into cakes suitable for the press.

1642. H. Hutchinson, merchant, 26, Rue Notre Dame des Victoires, Paris. Improvements in boots and shoes.

1644. J. and J. Cole, jun., Coventry, pattern designers. Improvements in looms for weaving.

Dated July 2, 1863.

1650. F. Ransome, Ipswich. Improvements in coating or preserving iron ships or vessels, or iron used for other purposes.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated July 1, 1863.

1643. G. T. Bousfield, Loughborough-park, Brixton. A new and useful machine for preparing cotton wool, or other fibrous material. (A communication.)

Dated July 4, 1863.

1667. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. An improved machine constructed on self-moving principles for obtaining motive power. (A communication.)

Dated July 4, 1863.

1668. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. Improvements in the manufacture of telegraphic wires, and in the apparatus connected therewith. (A communication.)

Dated July 7, 1863.

1690. G. P. Reed, United States. Certain new and useful improvements in watches or timekeepers.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, July 14, 1863.

577. O. Murrell. Generating steam.
585. J. S. Wells. Manufacture of stockings.
587. T. E. Symonds. Steering ships.
589. R. Saunders. Metal sheathing.
590. G. F. Lyster. Mooring buoys.
601. J. Pollard. Warp-dressing. (A communication.)
602. C. M. Palmer and J. McIntyre. Applying and fastening metal sheathing.
603. J. F. Gits. Revivification of charcoal.
607. E. A. Wünsch. Treating seaweed.
615. W. Whittle. Manufacture of nails.
616. T., E., and R. Thornton. Preparing fibrous substances for spinning.
617. J. Clinton. Construction of flutes.
623. S. H. Foster and T. Bunney. Looped fabrics.
624. J. Miller. Horticultural buildings.
626. T. W. Osborne. Improvements in lamps.
632. W. H. Buckland. Producing gas for illuminating purposes.
635. A. W. Makinson. Locomotive and stationary engines.
642. T. G. Webb Manufacture of articles of pressed glass.
648. H. A. Bonneville. Removing stains. (A communication.)
649. J. Isherwood. Working presses.
652. W. Inglis. Steam boilers and engines.
662. R. A. Brooman. Voltaic belts and bandages.
672. J. Renshaw. Dressing, raising, and brushing silk and cotton velvets.
673. W. Rossetter. Beam warping machines.
676. L. Desens. Bath or bathing machine.
677. W. Clark. Breech-loading firearms. (A communication.)
681. J. Harris. Rolling armour plates.
687. J. H. Johnson. Fastenings. (A communication.)
694. J. Tangye. Hydraulic punching machines.
703. T. W. Willett. Reefing and furling square sails.
715. J. Cox. Swimming baths.
750. C. Pryse and D. Kirkwood. Breech-loading firearms.
797. J. Norton. Projectiles or ignition missiles.
801. J. Grantham. Manufacturing compressed fuel.
805. W. Clark. Winding or copping frames. (A communication.)
839. W. Clark. Preventing fermentation in alcoholic and other liquids. (A communication.)
845. W. H. Phillips. Cleaning the bottoms of ships or other floating vessels.
1291. A. W. Hofmann. Preparing colouring matters.
1324. M. Henry. Raising, forcing, and moving fluids. (A communication.)
1335. F. R. Piltz. Producing ornamental surfaces.
1339. C. E. Laederich. Watches.
1409. A. J. Hollingsworth. Improved spirit compass with screw lever.
1546. G. Haseltine. An improved oil. (A communication.)
1594. J. L. Hughes. Ornamenting porcelain.
1616. W. and J. Bradshaw. Looms.
1622. H. Hutchinson. Boots and shoes.
1643. G. T. Bousfield. Preparing materials. (A communication.)

LIST OF SEALED PATENTS.

Sealed July 10, 1863.

106. C. H. Townsend and J. Young.
107. R. A. Brooman.
118. J. Butler.
129. E. Howes.
130. T. C. Barraclough.
132. J. Harrop.
134. R. Ferrier.
140. A. Prince.
141. W. E. Newton.
152. I. Ashe.
202. N. Wood.
259. E. G. Muntz.
292. F. G. Grice.
391. J. Grantham.
682. C. T. & A. Lutwyche.
741. G. H. Smith.
1090. E. Mitchell.

Sealed July 14, 1863.

131. T. C. Barraclough.
133. G. Graham and J. McLeod.
137. J. P. Bath.
139. J. W. Child.
143. R. A. Brooman.
150. J. Edwards.
157. E. Sabel.
164. J. J. Lundy.
185. W. Clark.
187. E. Bazin.
189. Sir C. Lindsay.
230. A. L. Liétout.
314. G. T. Bousfield.
321. J. A. Manning.
408. W. Clark.
437. D. Tassin.
457. W. Trustrum.
467. W. Clark.
468. W. Clark.
485. W. H. Gauntlett.
514. W. Clark.
598. D. B. Parsons.
644. W. E. Newton.
906. S. A. Couperie.
1007. J. W. Proffitt and W. L. Duncan.
1047. H. E. Carchon and E. F. Raybaud.
1099. J. Badart.
1159. G. T. Bousfield.
1218. G. T. Bousfield.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1644. R. Pollit.
1673. G. Davies.
1683. F. Ayckbourn.
1685. F. Mordan.
1695. C. G. Hill.
1696. W. and W. Allen.
1709. A. V. Newton.
1751. W. Barrett.
1795. W. E. Taylor.
1834. G. C. Ange.
1871. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1590. A. L. S. and E. C. A. Chenot.
1616. W. B. Adams.
1635. J. Fowler and W. Worby.
1720. R. Richardson and J. E. Billups.
1766. E., T., A., and W. Lord.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending July 11, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
3163	1 8	3224	0 4	3251	0 4	3264	0 10	3274	0 10	3279	0 8
3212	0 10	3236	0 6	3257	0 4	3267	0 4	3276	0 4	3280	0 4
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3223	1 4	3249	0 6	3263	0 6	3273	0 4	3278	0 4	3284	0 4

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-bdgs, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£ s. d.	£ s. d.	
Iron:—				
Welsh Bars, in London	per ton	6 5 0 to	6 15 0	2½
Nail Rods	do	7 0 0	7 5 0	
Hoops	do	8 6 0	8 10 0	
Sheets, single	do	9 5 0	9 15 0	
Staffordshire Bars	do	7 10 0	8 0 0	
Bars, in Wales	do	6 10 0	6 2 6	
Rails	do	6 16 0	6 6 0	net
Foundry Pigs, at Glasg, No 1	do	2 14 0	2 16 0	
Swedish Bars	do	11 10 0	12 0 0	2½
Steel:—				
Swedish Keg, hammered	do	16 0 0	0 0 0	
Swedish Faggot	do	17 0 0	18 0 0	
Copper:—				
Sheet & Sheathing, & Bolts	do	90 0 0	0 0 0	
Hammered Bottoms	do	109 0 0	0 0 0	
Flat Bottoms, not Hamrd	do	101 0 0	0 0 0	
Tough Cake and Ingot	do	92 0 0	0 0 0	
Tile Copper	do	89 0 0	0 0 0	
Best Selected	do	95 0 0	0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10	0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½	0 0 0	
Fine Foreign	per ton	97 0 0	100 0 0	
Tin:—				
English Block	per cwt.	6 2 0	0 0 0	2½
do Bar	do	6 3 0	0 0 0	
do Refined	do	6 8 0	0 0 0	
Banca	do	6 11 0	0 0 0	net
Straits	do	6 6 0	6 7 0	
Tin Plates:—				
Best Charcoal, I.C.	per box	1 8 6	1 9 6	
Second Quality	do	1 7 0	1 7 6	
Coke	do	1 3 0	1 4 0	
Lead:—				
Pig, English	per ton	20 10 0	22 15 0	2½
„ Spanish Soft	do	19 17 6	19 10 0	
Shot, Patent	do	23 10 0	0 0 0	
Sheet	do	21 10 0	0 0 0	
White	do	27 0 0	27 10 0	
Spelter:—				
On the spot	do	17 10 0	18 7 6	net
Zinc:—				
English Sheet	do	23 0 0	0 0 0	2½
Quicksilver	per btl.	7 0 0	0 0 0	3
Regulus of Antimony:—				
French star	per ton	42 0 0	0 2 0	0

Timber, duty 1s. per load, drawback 1s.

Teak ... load	£12 0	£13 0	Archangel, yellow	£13 0	£13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
„ yellow pine	3 10	4 10	Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0	Memel	10 0	15 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
„ birch	3 10	4 10	„ white	9 0	9 [illegible]
„ elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderhamn	9 10	10 10
„ fir	2 10	3 10	Christiania, per C.,		
Memel fir	3 5	3 10	12ft. by 3 by 9 in.		
Riga	3 0	3 5	Christiania, yellow	21 0	23 0
Swedish	2 10	2 15	Deck Plank Dantzic,		
Masts, Quebec red pine	5 0	6 0	per 40 ft. 3 in.	0 14	1 4
„ yellow pine	5 0	6 0	Pumice Stone pr ton	5 10	9 0
Lathwood, Dantzic, fm	5 10	6 10	Oils, &c.		
„ St. Petersburg	8 0	8 10	Seal, pale ...per tun	47 0	0 0
Deals, per C., 12 ft. by 3			Sperm body	80 0	81 0
by 9 in., duty 2s. per			Cod	53 0	55 0
load, drawback 2s.			Whale, Sth Sea, pale	45 0	45 10
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	60 0	0 0
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	47 10	0 0
Yellow pine, per re-			Palm, fine	36 0	0 0
duced C.			Linseed	45 0	0 0
Canada, 1st qual.	17 0	18 0	Rapeseed Eng. pale	45 0	0 0
„ 2nd do.	11 0	12 0	Cottonseed	31 0	34 0

FRENCH & SMITH, Sworn Brokers, 4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 24, 1863.

COMMUNICATION BETWEEN PASSENGERS AND GUARDS.

It is quite impossible to find a parallel for the position in which the traveller places himself on an English railway. Not only is he exposed to dangers and risks of a very peculiar kind, but he has in addition to submit unresistingly to them, without the power of making his condition known. The sufferer has not even the poor consolation of saying with truth, that he did all in his power to avoid evils which result in broken bones, ruined constitutions, or melancholy bereavements. The mere fact of entering a carriage, under existing arrangements, deprives the traveller of all that liberty which he prizes so much. Locked up in a compartment, he surrenders himself body and soul, into the hands of those who act for him; think for him; nominally take care of him, and deliver him—if all goes well—at his destination in good preservation, as they would a bale of goods, an ox, or a horse. The railway passenger has no identity, no individuality, and certainly no power, while the train is in motion; at a station, the matter is slightly different, very slightly; and even though each passenger there ruled as an autocrat, once the whistle sounds, and the open country is entered, that power is gone, and strong or weak, old or young, he is left depending wholly on his own resources, without the means of obtaining aid even in a death struggle. As a consequence, we find crimes committed; episodes enacted in the compartments of railway carriages, which, converting them into the semblance of slaughter-houses, make thousands who are daily exposed to the lik tremble with that worst of all terrors, a nameless dread. Such things are rare; had it been otherwise, precautions, effectual enough, would have been taken against their recurrence long since; but they are none the less fearful or deplorable for their rarity, nor does the fact exonerate those in authority from the responibility of permitting a state of affairs to exist, which gives ample scope to the lunatic, or the criminal, for the commission of deeds the very mention of which is heard with a shudder.

On Thursday last, a compartment in a second-class carriage of the Liverpool express to Euston, was the scene of a fearful struggle: strong men fought to take and preserve life, as men only fight with such objects in view. Michael Lyons, a traveller to all appearance, highly respectable, furiously attacked two of his fellow-passengers with a knife, when near Bletchly. The train being express did not stop for fifty or sixty minutes afterwards, until which time, of course, those attacked could receive no aid. Fortunately, they were both strong men; and the lunatic—for such we presume him to be—was overcome after a contest which converted the carriage into a shambles. Had it been otherwise, had those attacked been weak women or helpless invalids, the result would, of course, have been far more disastrous. That the matter fortunately terminated as it did, is not due to any precautions taken by railway officials, but simply to what is called, (properly or improperly,) chance—to a species of hap-hazard, in fact, which should have no existence in railway routine.

Now, were such an occurrence unique, we might have passed it over in silence; were it impossible to prevent its recurrence, to that silence we would have added regret; but as it is neither without a parallel, nor unavoidable in future, we assert that such an assault is to the last degree disgraceful to railway management. On no other railways but those of Great Britain do we find men treated as irrational beings, confined for hours together without the power of communicating their wants or their wishes to those who can aid or assist. Events daily place in a more prominent light the absolute necessity for an efficient means of communication between passengers and railway guards. Such an episode as that we have detailed is no slight matter to be passed over in silence. It is suggestive in the highest degree. It contains a warning which railway directors would do well to regard calmly, dispassionately, like reasonable men. It shows in a sufficiently fearful light one of the dangers resulting from that species of incarceration, to which they day by day needlessly condemn travellers—an isolation which is conducive to the most terrible results, and the longer continuance of which is not only unnecessary but criminal. Let a free communication exist between guards and passengers. No complicated contrivance is necessary for the attainment of such a result. If existing arrangements preclude the adoption of a means by which the guard can pass from end to end of the train he has in charge, there is at least nothing to prevent the adaptation of other and scarcely less useful means to the same end. A signa cord, accessible to all the passengers, is universally employed on every railway in America; and on very many Continental lines as well. The abuse of the privilege thus conferred is quite unknown. Are our railway travellers less steady and sensible than foreigners? The idea that it would be used by foolish boys for a "lark," or by timid women from the fear of imaginary dangers, is absurd.

Railway companies have hitherto treated the matter with a magnificent apathy; they have neither raised their voices for nor against the novelty; they simply have done nothing. On a few lines the guard and engine-driver are placed *en rapport*, it is true; but passengers are still treated as "goods" all over the kingdom. It is high time that such contemptuous sloth was shaken off. Such an occurrence as that of Thursday last is a terrible stimulus to exertion, which we trust will not need repetition.

LIGHT STEAM BOILERS.

The actual quantity of boiling water, required for the safe development of a given amount of steam power in a certain time, is a question which has never yet been decided, and most probably never will. So long as the heated plates, of a flue or a fire-box, are in contact with a depth of fluid sufficient to absorb all the heat imparted to them, it seems likely enough that every necessary purpose is fulfilled; but what the exact quantity required for the attainment of this object is, must remain for the present, at least, a doubtful point, depending not only on the description of plates employed, and the quality of the water used, but on the the intensity of the draft, the quality of the fuel, and many other points of detail, too various and uncertain to permit a very close approach to theoretical limits in practice. The ambiguity of the question, or its answer, does not, however, lessen their importance. The largest field for the employment of steam power is found in our naval and mercantile marine, and there at least, does the question of the reduction of every portion of the machinery, to the smallest possible limit of weight, assume the greatest importance; and very little reflection is required to convince us that that form of steam generator is most suitable for marine purposes, which will work safely and economically with the least possible quantity of water.

Whatever improvements may have taken place in our marine engines, it is certain that they have been few enough in the marine boiler. Since the introduction of tube flues, little or no alteration has taken place in the general principles of its construction, or in those matters of detail on which its suitability to its position depends. It still exists in all the clumsy majesty of size, much as it did half a century ago. Alterations in its internal arrangements have been few; in its external form still fewer; and for the sake of securing some important advantages, our engineers have been content to sacrifice many things equally valuable. As a result, we still find our ships encumbered with huge structures of plate iron, costly to make, difficult to repair, and of the very worst possible form for fulfilling one at least, of the legitimate purposes of a steam generator, that of sustaining a heavy pressure exerted within it. When anything above a nominal pressure is required, the engineer is compelled to resort to the use of stays to such an extent, that the interior of the boiler is rendered almost inaccessible for repairs or examination, while its weight and cost are seriously increased. Nor are these the least evils induced by its defective form. From the peculiar arrangement of up-takes and ashpits, stokeholes are, as a rule, almost unfit for the existence of human beings within them, the last refinements of ventilation being necessary to render them endurable when situated at the bottom of a large vessel; man-of-war or merchantman. The worst defect of all is found in the fact, that these boilers carry tons of water, to accomplish results attained as easily in other situations, by cwt. weights of the liquid.

It is pretty certain that a given area of heating surface will produce nearly similar quantities of steam, by the combustion of equal weights of fuel, whether it is covered with water to the depth of an inch or a foot; whether the boiler, in fact, contains a gallon, or a hogshead; a cwt., or 10 tons. Certain rules are, it is true, laid down by James Watt and others, for determining the proper area of evaporating surface, &c., which a well-proportioned boiler should possess. Such rules are, however, simply absurd in a general sense; the heating surface with which the water is in actual contact being, of course, the most important measure of boiler horse-power. The cubic contents of the space filled with fluid, that occupied by steam, and the water surface exposed, are merely matters of detail, which can only affect the quality of the steam supplied to the engines, and have little or nothing to do with its quantity; save in one respect, which is simply, that the reduction of the quantity of water contained in a boiler, is always accompanied by an increase in the economical production of steam, from the very obvious reason that the agitation of many tons of any liquid by the process of ebullition, must waste power to a very considerable extent; consequently, any reduction in its quantity is attended by a proportionate diminution of this waste. Most engineers are well aware of this fact. Thus, Mr. Armstrong states, in his valuable work on steam boilers, that he has found considerable advantage accrue from the introduction of hard-baked bricks, within the water space in large waggon and cylindrical boilers.

There are, however, other considerations besides questions of economy or convenience, which must regulate the amount of water-space

allowed in a generator. We usually find that the extent and form of the heating surface is its real measure, far more than anything else. And these, again depend on shipboard, in a great degree on external agencies, which have nothing whatever to do with engine or boiler, except so far as they govern their shape and size. The weight of a boiler does not, however, depend on the greater or lesser extent of water-space which it affords, but on the heating surface—in well-constructed boilers at least whose external superficies bear a very small proportion to the surface exposed to the direct action of the heat in the fire-box or flues. No matter what form that surface may assume, the metal of which it is composed should form a large proportion of that employed in the construction of the boiler, and must influence its weight more than any other consideration. We thus meet with generators, every now and then, which develop as much useful effect with a few gallons of water as ordinary boilers do with tons. But these generators are never light in an equal proportion; and the ardent pursuit after a boiler, light in this sense, is really a mere waste of talent, time, and money. We are, however, speaking just now more particularly of the marine boiler; and although we do not believe that its weight, when empty, can be materially reduced by any change in form or construction, we nevertheless feel certain that its weight—when taken as a whole, with its contained water, as a distinct apparatus for the production of power—is excessive, and that its reduction to reasonable limits should be one of the first objects of the engineer.

That this desirable end will ever be attained while we retain the use of flues returning over the fire-boxes, we very much doubt, because this arrangement of heating surface requires the employment of an immense quantity of water, not because it is in any way necessary to the effectual absorption of the heat produced in the furnaces; nor yet because dry steam cannot be supplied without it, but solely because large spaces are left within the boiler which cannot be so conveniently occupied by anything else. Thus, we find a distance of 8 in. or 12 in. at least, left between the crowns of the furnaces and the lowest rows of tubes, in order that a man may find access to the fire-boxes when they require repairs. 3 in. of water over a fire-box are ample under other arrangements; and we know that the excessive space now provided, easily accommodates many tons of dead weight, which is of no possible service. Few engineers who have gone into the subject in a proper spirit, will be disposed to assert that a boiler can be constructed on correct principles, which entails the necessity of carrying about, and heating, tons of water in no wise essential to the working of the propelling machinery; or that it can possess any compensating advantages which preclude the idea of its supersedal by generators of a different form. Its retention in service now, is we believe, in a great degree due to that conservatism on which we have dwelt sufficiently in a previous article, aided by the failure of novelties whose introduction we could not, under any circumstances regard as a step in the right direction.

We must remember that this question of marine boiler improvement daily presents itself to our notice in a more important light. However suitable the present normal form may be for pressures below 15 lb. or 20 lb., it signally fails when that pressure is exceeded. No amount of staying can possibly convert it then into a safe and economical generator. The growing tendency to employ high-pressure steam, the active competition in marine engine building, render its remodelling a question of the utmost importance—a question which should neither be slurred over, nor treated with haste and carelessness. We are heretics enough to believe that it would have been better for the marine engine at least, that a condenser had never been invented at the time it was. The possibility of attaining a paltry vacuum of 10 lb. or 12 lb. to the inch, has been the greatest bar to real progress the steam engine ever encountered. Had no such thing been attainable, we would long since have had propelling machinery as light and as simple at sea, as we have on our railways, where a vacuum was and is unattainable. At sea, that which should have been employed as a good servant has become a bad master, to whom space, money, and every other consideration are given up, in order to obtain results, the advantage of which are at best quite inadequate to the sacrifices made.

That the present form of marine boiler will be much longer retained, we doubt; that it will be replaced by something much better, we believe. Indeed, unless we wilfully shut our eyes to the light and experience afforded us by locomotive engineering, we can scarcely go astray. The boiler of the locomotive is, after all, the best which has ever been designed for the development of vast power within a limited space, and it requires but trifling modification to render it as suitable for the purposes of propulsion at sea as on land. The reduction of weight and space, the economy of fuel, the facility for carrying the highest pressures with ease and safety, which its use would secure, are advantages sufficiently important to outweigh all considerations of extra expense even if they existed. What we want on ship board is simplicity, not complication; and it is much better that we should avail ourselves of what is known and tried, rather than introduce novelties of which past experience tells us nothing.

THE ROYAL AGRICULTURAL SOCIETY.

THE MEETING AT WORCESTER.

(From our Special Correspondent.)

By the close of to-day, one of the most successful Great Meetings of the Royal Agricultural Society—the 25th in the series—will have come to an end. The 5,839 inanimate exhibits, covering a space 600 yards long by 200 wide, and representing a capital of thousands upon thousands of pounds; the 330 exhibitors with their numerous assistants; the multitude of visitors attracted by the Great Fair, will all be shortly dispersed to the four winds of heaven, and the good old city of Worcester will subside once more into its pristine provincial quietude. No doubt that all concerned—implements, exhibitors, and visitors—will have profited, each in their several ways, by the meeting. Many of the implements will reappear, in improved forms, at future shows; all the exhibitors will have gained in experience, the greater part in extended connection, and many perhaps, in pocket; while the agriculturists will have been enabled, by a practical and ocular examination, to choose the implements the best suited to their several special wants. Even to the casual visitor and pleasure seeker, the view of such an agrico-mechanical show may suggest lessons of interest and importance. Upon no slight foundation, the sight of such a collection of implements for supplying human wants, might raise up a theory of human progress, founded upon the advancing stages of man's dominion over labour. Between the savage with his stone hatchet, and the civilized man with his steam engine, there are several stages of progress; but each takes its stamp from the expedients adopted to lighten toil. The first step beyond savagery is evidently the subjugation of beasts of burden. Then comes the use by man of his fellow-men as slaves. The third and perhaps last stage is the employment of the inanimate forces of nature in the fulfilment of daily wants. These several stages are all commemorated in the history of our own little island, and each step can still be seen in progress in different parts of the world; while at such a collection as the one at Worcester, almost every mechanical operation connected with the preparation and supply of food may be seen—from a steam cultivator, capable of ploughing an acre an hour 12 in. deep, to a Yankee apple-paring machine.

In attempting to give an account of this great agrico-mechanical meeting, we feel the difficulty that is always met with when translating mechanical combinations into words. The real engineering language is graphic delineation; no "word-painting," however clear and eloquent, can convey mechanical ideas with the certainty and completeness to be obtained by the combination of a few lines. Next to seeing a machine itself, the next best thing is to see its delineation; and even a rough chalk sketch has often more significance than the most elaborate description. It would be impracticable for us to give illustrations of any of the exhibits at such a short notice; but, fortunately, however, we are able to refer to back numbers for illustrated descriptions of many of the articles exhibited; and we hope to describe more completely at a future period some of the more complicated and interesting objects—such as the ingeniously constructed dynamometers, employed by Mr. Amos, C.E., the Consulting Engineer of the Society, for testing the power consumed in working the various implements. An engine, a steam-plough, a horse-plough, a thrasher, a machine worked by hand power, each and severally requires a dynamometer of a different construction for testing the consumption of power; and these apparatus appeared to us to embody features of greater mechanical interest than perhaps any other machines on the gronnd.

The Exhibits.

Clayton, Shuttleworth, and Co., of Lincoln, exhibited a 12-horse, two 8-horse, a 7-horse, a 6-horse, and a 4-horse power portable engine, and a 10-horse and an 8-horse power stationary engine. They also shewed a 5-horse power portable engine, combined with one of Appold's centrifugal pumps, and a 10-horse power double cylinder traction engine, specially intended for dragging thrashing machines from farm to farm. Its chief novelty consisted in the use of a self-acting compensating motion for keeping both wheels in gear when turning curves. The complete utility of, or rather necessity for, this arrangement, appears to us to be rather questionable. All these exhibits are of the excellent Stamp-End pattern. This firm also sends one of their treble-blast finishing thrashers; an independent fixed finishing thrasher; a combined portable double-blast finishing machine; a combined single machine; a combined double machine; and 2 straw elevators—one on Hayes' plan, and the other on Campain's. Two grinding mills and a couple of circular saw-benches, complete the list of things at the Stamp-End stand.

Aveling and Porter, of Rochester, sent three of Mr. Aveling's traction engines, the use of which appears to be extending. We fully described these engines in our number for February 27th. Several of the other makers pay a

royalty for the partial or entire use of Mr. Aveling's patented plan of traction engine; amongst whom we may mention Messrs. Garrett of Leiston, and Brown and Mays of Devizes—the latter of whom, however, have placed their engine boiler on springs and a locomotive side-framing. The engine is of 8-horse power, with a cylinder of 9 in. in diameter, and the tender, at the back of the fire-box, can contain sufficient water for a six-miles' run, and coals for fifteen to twenty miles. From its being built with a pitch chain on each side for the two speeds, the engine does not present the simple appearance of Aveling's traction engine, and it is also too close down to the ground—which would lead to difficulties in soft soil.

James Haywood, jun., of Derby, exhibited a 10-horse power fixed engine and an 8-horse power portable, both of which were tested, and their performances appear further down. These two engines were furnished with a peculiar governor, which—as it procured the great advantage of a variable expansion—deserves further notice. An expansion valve was used, worked by an extra eccentric loose on the shaft. The governor itself was of the gyroscopic kind, mainly consisting of a heavy ring revolving at an inclined plane to the axis of the shaft. Any variation in the speed caused a proportionate change in the inclination, and these alterations were communicated to the loose eccentric on the shaft by an arrangement of bevel gearing similar to the one adopted in Siemens' governor. A French portable engine in the International Exhibition—that of Albaret—also employed a gyroscopic governor and the arrangement seems worthy of notice by those interested in introducing in a simple form the invaluable principle of variable expansion.. It appeared to us that this gyroscopic governor might be combined with Dubbs' arrangement of using one eccentric for reversing the valve gear of locomotives. The "wobbling" appearance of the gyroscopic apparatus is rather a drawback, but this might be corrected to a great extent. The firm also exhibited some thrashing machines, a variety of chaff-cutters, and we noticed some very neat cast-iron garden chairs at this stand.

Messrs. Clinton and Owens (late B. Fowler and Co.) exhibited no less than 80 different articles of their manufacture. We noticed a very neat arrangement of combined steam-engine and pumps, consisting of a 6-horse power horizontal engine, 8 in. cylinder, 12 in. stroke, working a set of treble 4 in. plunger pumps, the whole on one strong bed-plate. It was intended for supplying a nobleman's country house with water. We also noticed at this stand a useful shape of double-action force-pump, for breweries, &c., with a central and easily accessible position of valve chamber. Mr. C. Fynes Clinton, the senior partner in this firm, was formerly one of the favourite pupils of Mr. William Fairbairn, of Manchester.

Marshall, Sons, and Co., of Gainsborough, sent a 10-horse, an 8-horse double cylinder, and a 2½-horse power portable engine, very much after the Stamp-End pattern. They also exhibited some thrashing machines and saw-benches of very good wormanship.

J. B. Brown and Co., Cannon-street, made an appearance with a great variety of articles, amongst which we noticed a number of Shanks' neat lawn-mowers, and one of the compact little engines with an upright boiler made by this firm, and also exhibited last year at the Battersea show.

Messrs. Burgess and Key exhibited several of the very complete reapers of Mr. McCormick, of Chicago—that most fortunate of all patentees. They also sent a variety of chaff-cutters and churns, and a couple of their excellent mowers.

Mr. Henry Mulliner, of Leamington, exhibited a patent wheel, made in the same manner as the wheels of some of the American carriages shown in the American Court of the late International Exhibition. The entire round of the wheel was formed of only two pieces of wood, bent by machinery to the required shape; instead of the usual plan of using one felloe to each couple of spokes. We do not see that this achievement could be properly carried out with any other wood than the wonderfully tough American hickory.

Another local exhibitor was Mr. Gilbert, of Evesham, who sent a portable engine with an oscillating cylinder; a peculiarity of construction which we should think to be very uncalled for in an engine of this class.

Mr. Stephen Holman showed a variety of hydraulic apparatus, amongst which we noticed a very useful tool for engineers; a neat hydraulic punching bear by Tangye and Co., for punching ¾ in. holes through ½ in. plate.

Bury and Pollard worked one of their neat double-acting pumps by means of an extremely ingenious self-regulating windmill, invented by W. H. Zahn, of New York. We remember that this wind engine was also exhibited in the American Court of the International Exhibition. The peculiarity of the apparatus consists in the eight sails being self-regulating, and they can thus work day and night without attention. The sails are caused to present more surface to the wind, in proportion to the force of the wind acting on self-adjustable springs attached to each sail.

The "new implements" exhibited at the stand of the real steam cultivation pioneer—Mr. John Fowler—were a five-tined cultivator and subsoiler; a harrow and cultivator, and also a drill, for working alongside of the cultivator.

It is to be regretted that the traction engines were not submitted to any competitive test. Robey and Co. exhibited a 12-horse 8 in. double cylinder traction engine. The hind pair of wheels are 6 ft. in diameter with a 12 in. face, and the steering wheels are 4 ft. 6 in. in diameter, and 10 in. broad. Two chains are used for a purpose that might be fulfilled with one; and both are of the same size, although one has to go through three times as much work as the other. The driving wheels appear too light, and show symptoms of the spokes working loose in the tyre. Allchin and Son, of Northampton, exhibited a very well arranged traction engine. It is of 10-horse power, with a steel boiler, fed with a pump and a Giffard's injector. The working parts are all of steel; and the cylinder, 8½ in. in diameter, is placed in the smoke-box. The driving wheels are 6 ft. in diameter, and 13½ in. wide; and the whole is mounted on india-rubber springs. The wheels appear too light, and were cracked in some places. The chain of Lee and Co.'s traction engine is a rather rough job, and the wheels have too small a surface for soft ground. Garrett's traction engine, on Aveling's plan, is a good strong job. The general use at present of springs to the "traction engines," is a feature of improvement that will evidently conduce to their durability.

As we stated last week, there is no implement of any marked novelty in the show, except, perhaps, the chaff-cutter we then noticed. Burrell, of Thetford, was absent from the Royal Agricultural Show—as indeed he has been for several years. Ransomes and Sims were completely unrepresented; and Garrett, of Leiston, only sent a traction engine. The mere recapitulation of the names of Hornsby and Sons, Tuxford and Sons, Barrett, Exall, and Andrews, Samuelson and Co., Amies and Barford, Holmes and Sons, Wallis, Haslam, and Steevens, &c., will sufficiently recal the character of their stands.

THE TRIALS.

Steam-engines Fixed and Portable.—The total amount of the prizes offered for this class of fixed and portable steam-engines, was £100—viz., £40 for the class of fixed steam-engines not exceeding 12-horse power; £10 for the boilers of such engines; £25 for the class of portable steam-engines above 8-horse power; and £25 for similar engines not exceeding 8-horse power. These prizes seem to have been divided, with a view of pleasing all parties; as in certain schools, where all the little boys who have not been outrageously bad, get some prize or other at the end of the year. However, we have no doubt that the judges can give excellent reasons for what they have done.

The fixed and portable steam-engines were tested under an oblong wooden shed erected in one corner of the trial-yard. About one-half of the longitudinal space was devoted to fixed engines, the other to portables. The "force-resisters," as they are termed in the society's prize-sheet—improved forms of De Prony's well-known friction brake—could be adjusted as required on a wooden tramway laid down inside the shed. Three of these dynamometers were used. They were constructed by Messrs. Easton and Amos, who, amongst other improvements, have dispensed with De Prony's long lever, thus increasing the accuracy and steadiness of the apparatus. A boiler on wheels, furnished by the society, was employed to test the stationary engines, and, placed on a wooden platform parallel to the tram under the shed for the dynamometers, it could be adjusted to any position in which the stationary engine under trial happened to be fixed. The steam was fed into the fixed engines through a piece of flexible piping. The engines, fixed and portable, were thus placed in the intermediate space between the two tramways, and straps furnished by each exhibitor communicated the power from the engines to the breaks. The portable engines were necessarily tested with greater facility, and could be at once brought in and off by a team of horses.

It may be mentioned that all the steam-gauges in the engines intended to work the machinery in motion, were previously tested by Mr. Amos. Some were found to vary as much as 6 lb. above the stipulated pressure of 45 lb. on the square inch, and others to the same amount below that pressure, when compared with the standard gauges in the possession of the society.

It seems to be generally supposed that the prizes for engines are adjudicated with reference merely to consumption of fuel. The judges stated, however, in the "prize-sheet," that regard will be had "to the price, simplicity of construction, probable durability of the whole and in detail, and the means provided for easy access to the working parts, and to economy of fuel." It is required that no fixed engine should exceed 10-horse nominal power, nor have a diameter of cylinder larger than 11½ in. "One of the portable engines must not be more than 8-horse nominal power, nor must the diameter of the cylinder be more than 9½ in." It is also required that the engine be taken to pieces, either before or after the trials, that the piston, slide, and valves, be open to examination by the judges. A smaller diameter of the tubes than 2¼ in. inside is not allowed; nor must

they be less than No. 12 wire gauge thick, nor have a smaller breadth of plate between them than 1 in. This year, the R. A. Society has permitted a pressure of 50 lb. on the square inch, being an increase of 5 lb. on the pressure allowed at the last steam-engine trials, at Chester, in July, 1858. As at all the former trials, Welsh Llangennych coal was used.

The portable engine being brought on to the ground, 7 lb. of coal and 1 lb. of wood per each horse power are carefully weighed and served out to the attendants, the number of whom, by the bye, is not determined by the regulations. The fire is then lighted and the fire-box fired, until the steam is got up to a pressure of 50 lb. on the square inch. The instant that this pressure is attained, all the coal out of the fire-box is taken away and weighed, and this weight deducted from the quantity first given, in order to afterwards ascertain the amount of coal consumed in raising the steam. The engine is then set to work and allowed to run against the weight on the dynamometers, until it is unable to keep up the required speed of the brake. A counter, adjusted to the brake, registered the number of revolutions.

The moment the engine stops, another portion of fuel is served out, consisting of 14 lb. of coal—no wood—and the steam is again got up to the pressure. of 50 lb. per square inch. At Chester, 1 lb. of wood per horse power was allowed for the second experiment. The engine is then started and allowed to run until the fuel is so far consumed that the engine can no longer keep up the required number of revolutions of the brake. Every means are used by the exhibitors to urge the expiring force of the engine, and the fire is always burnt so low that but a slight layer of ashes are visible in the grate. The fire-bars are purposely made very close together, and the coal is from the beginning broken up by a hammer into small pieces, about as big as a hazel nut. It is evident that the slightest accidental variation in the quality of even a small portion of the fuel would materially effect the result. When the engine can no longer keep the brake at the declared speed, it is stopped, and the total number of revolutions of the brake effected by the second bout, and recorded by the counter, are noted down.

The speed of the brake is of course got by multiplying the declared number of revolutions per minute of the engine by the radius of the driving pulley, and dividing the product by the radius of the brake pulley; the weight on the brake, or the load on the engine, is determined by the nominal power of the engine multiplied by 33,000, and divided by the circumference of centre of effect of the brake collar multiplied by the number of revolutions of the brake per minute; while the duty of engine, or the *mechanical time*, of either of the two experiments, is obtained by dividing the total number of revolutions recorded by the counter during the bout by the indicated number of revolutions of the engine per minute.

It would evidently give a very unsatisfactory result if only the coal consumed in the second run were taken into account; and "racing" engines, ingeniously furnished with firebricks in the fire-box, or by the adoption of other means, might, while getting up steam, acquire such a store of caloric as to distance other engines unprovided with such appurtenances. The fuel, however, consumed in getting up steam, is taken into account in the following manner:—In the same ratio that the number of revolutions recorded by the counter at the end of the second bout bear to the quantity of coal then consumed, so are the number of revolutions of the counter at the end of the first experiment to the quantity of coal not consumed in getting up steam. This amount being thus ascertained, it is deducted from the quantity used in the fire-box during the first experiment, and the difference represents the quantity consumed in getting up steam.

The following are the awards of the judges, as published on Monday last. The prizes are apparently given to the engines effecting the highest duty; as the relative merit in design, simplicity of construction, accessibility, &c., are very far from being equal in the different engines tested. The £10 prize for a 12-horse and under fixed steam-boiler was not competed for. The judges for these trials were D. K. Clark, Esq., C.E., late Superintendent of Machinery in the International Exhibition, and the author of the well-known work on Railway Machinery; G. V. Gooch, Esq., C.E.; Mr. Stewart, Midland Railway; assisted by Mr. James Easton, jun.

clothed fireboxes, variable expansions, &c. The result could not be doubtful—it would be like a race between a gentleman's thoroughbred and a farmer's cart-horse—and two engines from the same shop would have given widely-different results. The makers absolutely rejected the proposal, and refused to get up the steam. It will evidently be best for all parties for the society to adhere to its determination to ignore racing engines. Farmers and others do not want "racers," but rather useful cart-horses, and there are many simple means of diminishing the consumption of fuel without having recourse to such *tours de force* as were carried out in the exhibits that figure at the head of the awards. There was one exception to the general refusal to try the ordinary engines. The last engine in the above list—that of Messrs. Brown and May—was an ordinary portable. It is evident it would have been unfair in the judges to have enforced their requisition; for, as only one or two of the larger firms exhibited their ordinary engines besides the ones specially built fo

FIXED STEAM ENGINES.

Name of Exhibitor.	Catalogue No. of Article.	Horse Power of Engine.	Coal burnt per Hour, in lbs.	Coal burnt per Horse Power per Hour, in lbs.	Price.	Remarks.
Barrett, Exall, and Andrews	2537	10	48·8	4·88	£230	Prize of £15.
Clayton and Shuttleworth	141	10	50·4	5·04	240	Ditto of £15.
Hornsby and Sons	1945	10	55·1	5·51	245	Ditto of £10.
Ferrabee	3373	10	71·0	7·10	230	Commended as a plain serviceable engine.
Tuxford and Sons	5014	8	56·5	7·06	200	
Haywood, jun.	548	10	87·7	8·77	240	
Johnson and Whittaker	2867	4	61·3	15·32	85	

PORTABLE STEAM ENGINES.

Name of Exhibitor.	Catalogue No. of Article.	Horse-power of Engine.	GETTING UP STEAM: Time taken in getting up Steam.	GETTING UP STEAM: Fuel burnt in getting up Steam. Coal.	GETTING UP STEAM: Fuel burnt in getting up Steam. Wood	Coal burnt per hour in lbs.	Coal burnt per horse pwr. per hr.	Price of Engine.	Remarks.
TABLE I.				lb.	lb.			£	
Hornsby and Sons	1946	12	48	62·0	12	45·5	3·79	325	Prize of £10.
Clayton and Shuttleworth	142	12	99	47·0	12	46·3	3·86	343	Do. of £7.
Tuxford and Sons	5004	12	69	60·5	12	55·2	4·60	355	Do. of £4.
Barrett, Exall, and Andrews.	2539	12	123	67·0	12	55·8	4·05	310	Do. of £4.
Brown and May	5774	10	78	47·3	10	54·5	5·45	265	Commended.
TABLE II.									
Tuxford and Sons	5003	8	81	32·5	8	28·7	3·59	250	Prize of £9.
Barrett, Exall, and Andrews.	2538	8	99	50·2	8	30·3	3·79	230	Do. of £8.
Clayton and Shuttleworth	143	8	100	38·2	8	32·4	4·05	238	Do. of £7.
Holmes and Sons	1824	8	41	39·0	8	46·5	5·81	240	Do. of £1.
Haywood, jun.	549	8	76	41·0	8	44·1	5·51	240	Commended.
TABLE III.									
Ellis and Sons	4053	7	76	40·5	7	57·5	8·21	220	Commended as good serviceable engine.
Parsons	5246	8	63	34·0	8	70·6	8.82	225	Commended as good serviceable engine.
Warren (Ruston and Co.)	3653	8	95	41·5	8	75·6	9.45	230	
Gibbons	519	7	49	30·3	7	76·5	10·92	215	
Robey and Co.	4827	8	47	39·5	8	95·7	11·96	230	
A. B. Childs (Riches & Watts)	5779	8	69	44·0	8	96·0	12·00	200	
Ashby and Co.	5176	4½	73	36·5	4½	57·0	12·66	138	
Gilbert	1553	5	95	31·5	5	66·4	13·28	160	
Brown and May	5775	8	55	34·0	8	51·2	6·40	220	Highly commended.

Towards the conclusion of the above trials on Saturday, the judges wished to test the ordinary "commercial" engines of the firms whose "racers" had achieved the excellent results indicated in the tables. This request placed those eminent makers who could afford the expense of getting up "racers" in a somewhat difficult position. Their ordinary engines would have had to compete against their own "racers"—namely, engines, furnished with double-expansion valves, water-heating apparatuses, an extra number of tubes, mid feathers in the firebox, firebricks partly covering the grate, racing, those whose commercial engines were absent, would have been at an advantage.

Want of space compels us to defer publishing our notice of the trials of the steam cultivators threshers, and hand-dressing machines till next week.

Messrs. Aveling and Porter's traction engine has obtained the first prize silver medal, at the exhibitions held during the current month, at both Odense and Hamburgh. There were four competitors for the prize at the former, and eight at the latter, show.

ON A PACKING FOR PISTONS OF STEAM ENGINES AND PUMPS.*

By Mr. GEORGE M. MILLER, of Dublin.

THIS packing consists of two rings, pressed outwards against the cylinder by the pressure of the steam as it acts on the alternate faces of the piston, without the use of any springs. This construction of piston is used by the writer in the locomotive engines on the Great Southern and Western Railway of Ireland. The piston is of cast iron; 2 in. in thickness and 15 in. diameter. Two square grooves are turned in the edge of the piston, ⅜ in. in width and ¾ in. apart, and a corresponding steel ring is fitted into each groove, the rings being divided at one part with a plain butt joint, and sprung over the piston into their places. Two small holes, ¼ in. diameter, open from each face of the piston to the bottom of the nearest groove, whereby the steam is admitted behind the packing ring and presses it out against the cylinder so long as the steam is acting upon that face of the piston. The alternate action of the two rings is continued as long as the steam is acting on the piston, one of them being always pressed steam-tight against the cylinder.

Another form of the piston has been used in cases where the piston is desired to be flush on both faces or to fit a cylinder with flat covers; in this a circular flat head forged upon the piston rod is fitted between the turned faces of the two halves of a cast-iron piston, which are held together by turned pins riveted over, forming a hollow piston flush on both faces, fast upon the piston rod, and without any loose part besides the two packing rings.

The ends of the rings, where divided, are made either with a butt joint or a lapped joint. The piston body is turned to pass through the cylinder easily; and the joints of the rings have been found to be practically steam-tight. In some cases the joints have been tongued, as shown, but in the writer's experience this has has not been found requisite; the butt joint has invariably worked well, whilst it has the advantage of perfect simplicity of construction. In pistons where the packing ring travels over the opening of the cylinder port, a small stop is fixed in the bottom of the groove, entering a short slot in the packing ring, to prevent the ends of the ring coming opposite the cylinder port, but still leaving the ring free to travel round a little in the piston grooves; but it is preferred for the packing rings not to travel over the cylinder ports.

These steam-packed pistons have been used more than seven years in the locomotives of the Great Southern and Western Railway, and have proved so satisfactory and advantageous that their use has been extended to all the 94 locomotives working upon that line. The following are the results of the working in the engines running from Dublin, as regards the durability of one set of rings, the period of their wear, and the mileage of the engines whilst wearing them out. Nineteen engines working with one set of steel rings averaged 33,020 miles and 16½ months' running, one engine having worked for 3 years and run as much as 98,073 miles with one set of packing rings. Five engines working with one set of brass rings under the same circumstances averaged 30,986 miles and 19 months' running, the greatest work amongst them being 2¼ years and 43,197 miles. Twenty other engines with steel rings, which are still in use, have also averaged 40,444 miles and 21 months' work, one of these having worked for 3¼ years and run 94,899 miles with the original set of rings.

The general result of the above is that one set of steel packing rings have lasted 37,000 miles and 19 months' work, and one set of brass rings 31,000 miles and 19 months' work, the difference in durability being about 16 per cent. in favour of the steel rings. In some of the individual cases of the pistons with steel rings, a very considerable variation from the average result of 37,000 miles is found in the durability of the packing rings, some of them having lasted 2¼ times the average, and some only as much below the average. In the cases of the brass rings the variation is not so great, amounting to 1¼ times the average in the highest, and about as much below the average in the lowest. This variation in wear has not been fully accounted for: it may have occurred from a different character of metal in the cylinders, from priming of the boiler, and from the presence of grit in the water; but the writer has reason to believe that the rings have been frequently put in to work and set with a pressure upon the cylinder from their own elasticity, thus causing a source of wear. It is found the best plan to turn the rings to the exact diameter of the cylinder, and to put them in without any spring upon them, so that they are not subjected to any wear except when the steam is acting on them. The steel rings are now slightly tempered, to admit of their being sprung into the grooves without altering their form. In all these pistons the steel packing rings were ⅜ in. thick originally, and ⅜ in. wide, and they were worn down to about ⅛ in. thick in the thinnest part before being removed. The brass rings are worn down from 7-16ths in. until they are ¼ in. thick. Specimens were exhibited of steel rings from four engines that have worked 38,000, 61,000, 84,000, and 96,000 miles respectively, since first put into the pistons. It must be remarked, that, when opportunities occur, as when engines are under repair, the rings are taken out and reset to the size of the cylinder.

It is found in practice that two steam ports of ¼ in. diameter are quite sufficient for each of the steel packing rings. The rings must be made to fit easily in their grooves, so as to move freely, with a clearance of 1-16ths in. at the bottom of the grooves for the steam to pass round behind the rings. No difficulty has been experienced from the steam passages becoming stopped up a moderate use of tallow in the cylinders.

The use of this piston-packing in locomotive engines has been productive of economy by reducing the friction, and by prolonging the wear of both pistons and cylinders. It will be observed that only one ring is in action at the same time, and that when the steam is shut off, as in descending inclines and approaching stations, the piston is free to move without any friction. The cylinders of the four engines from which the specimen rings exhibited have been taken, show a highly polished surface, are very little worn, and are nearly parallel throughout. The operation of putting in these rings so as simply to fit the cylinder is extremely easy, whilst great care and skill are required in giving springs the requisite degree of elasticity, and in making them with maintain it.

A set of brass packing rings was also exhibited, taken out of the pistons of a pair of vertical stationary engine cylinders at the Dublin Railway station, in which they have been in constant work for the last four years, with a pressure of 50 lb. steam. The diameter of the cylinders is 19½ in., and the rings were originally ⅜ in. thick and ⅜ in. wide; they are now worn down to 5-16th in. thick.

A number of stationary engine pistons are working with these packing rings, and they have proved very durable and thoroughly satisfactory, giving an advantage in reduction of friction, and in preserving the cylinder face in perfect condition. In one case of the engine of the Oldbawn Paper Mill, near Dublin, with vertical cylinder 18 in. diameter and 2½ ft. stroke, working with 50 lb. steam, the cylinder had previously been worn considerably out of truth and much grooved, and one of these pistons was put in having two steel rings of ⅜ in. width and ⅜ in. thickness, and was in constant work for four years without the packing rings requiring renewal. They have lately been taken out for examination, and were found to be still ¼ in. thick; and the cylinder from its previous defective condition, has been brought completely to truth throughout, with a highly polished surface.

These packing rings have also been used for four years for pump buckets, and have proved very satisfactory. In one case of a double-acting pump 8 in. diameter, the two packing rings are of brass, ⅜ in. wide and 5-16ths in. thick; and are pressed out by the pressure of the water acting at the alternate faces of the bucket through two ports, ¼ inch diameter, similar to those in the steam pistons. This pump had two years' constant work at quarries and bridge foundations upon the Great Southern and Western Railway, before the packing rings required renewal.

In the case of single-acting pumps the bucket has only a single packing ring with ports opening from the upper side. A pump bucket 5 in. diameter has been working constantly for 2½ years at a station on the railway near Dublin. This bucket was exhibited, having been taken out for the purpose; the packing ring was originally ⅜ in. wide and ¼ in. thick, and has worn less the 1-16th inch in the 2½ years that it has been working up to the present time. As the diameter in this case is too small to allow of the ring being sprung over the body of the bucket into its place, it is put in by means of a junk ring screwed on at the under side of the bucket.

An application of the same construction of packing that has also been made to the gland packing of a 9 in. pump plunger, in which two brass packing rings are used, ⅜ in. wide and ⅜ in. thick, just like the piston packing rings, except that they act in the opposite direction, being pressed inwards upon the plunger by the pressure of the water through the ports.

Mr. Miller exhibited specimens of the steel packing rings from the pistons of four locomotives which had run from 38,000 to 96,000 miles; and also the brass packing rings from the pistons of the stationary engine, together with the bucket of the 5 in. single-acting pump referred to in the paper.

During the discussion which followed, Mr. J. Fernie said he was glad that the subject of packing rings for pistons, which were such an important part of a steam-engine, had been brought forward in the paper just read. He observed that steel packing rings had not been found to wear well in other instances in which they had been tried, and moreover they cut the cylinders; and he inquired whether the cylinders in which the steel rings had been working for so long a time were made of a very hard quality of metal.

Mr. Miller replied that the cylinders were cast as hard as they could be made, consistently with allowing of the subsequent boring. The packing rings were made of common shear steel, and sometimes wore down irregularly in thickness, but in many cases the wear was regular.

Mr. J. Fernie asked how the steel rings were made.

Mr. Miller said the steel was rolled in lengths of the required shape, but slightly tapering in section from the outer to the inner face, so that when bent into a circle the two edges of the ring became nearly parallel, giving the same depth of ring throughout its whole thickness. The bar was then bent in a miniature plate-bending machine, hammered to the size of the cylinder, and fitted into the groove in the piston by simply filing, without any other work being spent upon it. At first the rings were turned in a lathe out of a steel cylinder and then cut across, but it was found better to get steel rolled of the proper section for the purpose, and afterwards bend it and fit it by filing.

Mr. F. J. Bramwell inquired what amount of spring was given to the packing rings before they were put in their place, and whether the piston had ever been tried without admitting the steam behind the rings, in order to see how far it would be rendered steam-tight by the pressure of the rings alone without the steam behind them.

Mr. Miller explained that the packing rings were put in without any amount of spring of their own, being made no larger than the diameter of the cylinder, in order that there might be no pressure against the cylinder and therefore no wear whilst running with the steam shut off.

Mr. J. Fernie remarked that the steel packing rings in Mr. Ramsbottom's piston, generally

* Read before the Institution of Mechanical Engineers: Charles F. Beyer, Esq., in the chair.

three in number, were set with a certain amount of spring in themselves, by which the required pressure against the cylinder was obtained; and that plan required the cylinders to be of rather hard metal to stand the constant pressure in working. He inquired whether the brass packing rings that had been used had been adopted for the purpose of working in soft cylinders.

Mr. Miller said the rings first used with this mode of packing were brass, and after some time a set of steel rings was tried, the experiment being proceeded with rather cautiously from fear that the steel rings might cut the cylinder; but it was found they did not do so, if fitted in without any spring whatever in the rings themselves, but with only the steam behind pressing them against the cylinder. The result was that it very rarely occurred now that a cylinder required reboring: the cylinders not only preserved a fine smooth surface, but kept more parallel than under the old modes of packing the pistons. The reason of using the steel rings and discarding the brass was that the steel lasted about twice as long.

Mr. J. Fernie asked what was the weight of the steam-packed piston for a locomotive cylinder of 15 in. diameter.

Mr. Miller replied that the weight of a piston of that diameter was 64½ lb. without the rod, which was 2¾ in. diameter; the piston was 2 in. thick.

Mr. J. Fernie said they had tried some pistons on the Midland Railway on this principle of packing by the pressure of steam behind the rings; they were wrought iron pistons forged solid on the piston rods, and the packing rings were of brass ½ inch square in section. A very long mileage was got out of these rings, but it was found that with solid pistons there was a great deal of trouble from the necessity of getting the cross-heads off to draw the piston out, whenever it was wanted to do anything to the piston or look at the packing rings; and they had therefore now gone back to the old-fashioned piston with a junk ring bolted on the face for getting at the packing rings. The bearing surface was now reduced to 1 in. in the pistons; there were two ½ in. packing rings, and these gave a longer mileage than used to be got out of two 1¼ in. rings. A great width of bearing surface was not required, but a small bearing surface was preferable, provided the rings were made to fit the cylinder accurately all round; and Mr. Ramsbottom certainly had the credit of having first called attention to the advantage of narrow packing rings well fitted. The 16 in. piston now used in the Midland locomotives weighed 1¾ cwt., including the piston rod, having been reduced in weight 28 lb. below the previous make, in consequence of which a longer mileage was got out of the packing rings; the wear of the cylinders was also greatly reduced, a highly polished surface being maintained. Formerly there used to be a great deal of trouble from the cylinders wanting reboring, but now with the narrow packing rings and light pistons this was quite removed. He thought highly of the steam-packed piston, and the results obtained in the durability of the packing rings were certainly very extraordinary, 90,000 miles far exceeding any mileage previously attained. In his own experience about 20,000 miles was the durability of a set of ½ in. square brass rings, and then they would want setting up twice or three times during that period. He inquired how often the the steel packing rings had been set up before they were worn out.

Mr. Miller said the packing rings had not been examined and set up at stated times, but whenever the engine happened to be in for casual repairs the piston was taken out, and the rings examined and set out if required, by slightly hammering them all round to bring them again up to the exact diameter of the cylinder; or they were replaced by new rings if worn out. The results of mileage with the different sets of rings were drawn from a return of the exact mileage of all the engines that were working under his own observation.

Mr. F. J. Bramwell thought there would always be nearly the full pressure of the steam behind the rings that there was in the cylinder, judging from the quickness with which the steam filled the cylinder of an indicator through a small orifice.

Mr. Miller said that with the brass packing rings first tried the holes behind the rings were drilled ¼ in. diameter, but that size was found too large, and they were therefore reduced to ⅛ in. diameter, which proved to be sufficient for obtaining the required pressure to make the piston steam-tight in the cylinder.

The Chairman inquired whether the piston body was turned much smaller than the cylinder or only an easy fit.

Mr. Miller replied that the piston body was turned down to about 1-32 in. smaller diameter than the cylinder, so as to pass easily through it.

Mr. F. J. Bramwell asked whether the packing rings filled out to the size of the cylinder as they become worn, or whether when the steam was off they returned to their original inside diameter.

Mr. Miller replied that when taken out after a great deal of wear the packing rings were slightly smaller in diameter than the cylinder, and then required setting out by hammering. Sometimes they wore perfectly equally all round, and sometimes more at the ends or in the middle.

After some further discussion, the Chairman remarked that, after making and employing a great many descriptions of pistons, he thought the steam-packed piston described in the paper was a very good one, and it had the great advantage of being very simple in construction. Formerly, it was a great object to keep the steam out of the piston, on account of the internal packing springs; but in this piston the steam was admitted inside to act as the spring upon the packing. The practical feature of the new pistons was their great simplicity of construction; but to Mr. Ramsbottom was certainly due the credit of first simplifying the construction of pistons to so great an extent. He considered the piston now described ought undoubtedly to work well, because there was so little about it to get out of order, and it could not do otherwise than prove highly satisfactory. He proposed a vote of thanks to Mr. Miller for his paper, which was passed.

SPIGHTS' HORSE-HOE.

THE annexed engravings represent an invention recently patented by Mr. J. Spight, of Glandford Briggs, Lincoln. The invention is an improvement on one for which Letters Patent was granted in 1859. In that patent the hoes were attached to

FIG. 1.

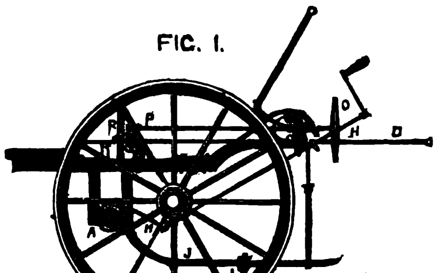
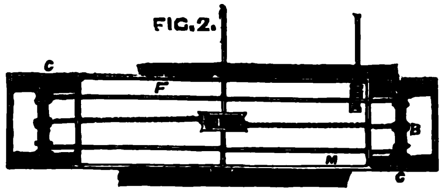


FIG. 2.



levers connected with a revolving shaft, working in a slide frame having bearings at each end, and which shaft could be raised or lowered as required for different kinds of corn or roots. The present improvement consists in suspending the shaft or bar to which the hoes are attached upon a bearing at its centre, instead of at each end, so that when one end is raised by turning a handle or otherwise, the other end is lowered in a corresponding degree, and thus when working over ridged or curved surfaces, or along what are called "lands," the depth or bite of the hoes may be regulated by the attendant with the greatest nicety.

Fig. 1 is a side view of the implement; fig. 2, a plan of the top frame, hangers, brackets, and steering shaft.

In fig. 1 the horizontal shaft P moves a wheel Q which works into the rack R. This rack is attached to the balance frame M, which works between the guide plates N, and which is raised or lowered by the steerer turning the wheel O. C, C, are brackets in which the hangers B move, and which also carry the revolving shaft A, to which the hoe-levers J, J, are attached. It will be seen that the hoes can be made to work on a level, or one end can be raised higher than the other when desired by the steerer if he is working on uneven or ridged land.

GOULDING'S PLOUGHS.

THE invention hereafter described has been recently patented by Mr. W. Goulding, of Leicester.

The invention has for its object improvements in ploughs. For these purposes the land side of the body of the plough in place of being upright, or as nearly so as may be in respect to the sole of a plough, is formed in such manner as to incline from the sole over towards the furrow side of the plough; and the beam where it is fastened to the body, in place of being directly over the land edge of the sole, comes more over towards the furrow side edge of the sole of a plough, by which the plough will be in a better state of balance and equilibrium than heretofore. The invention will be fully understood by referring to the engravings.

Fig. 1 is a side view; fig. 2, a plan; fig. 3, an end view of a portion of a plough, constructed according to this invention. *a* is the body or frame of the plough, shown separately in fig. 4, which is

FIG. 1.

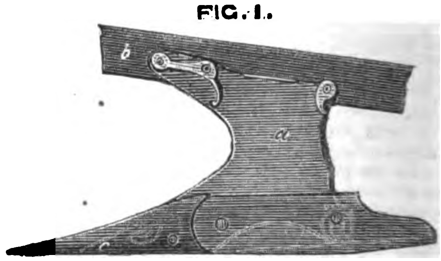
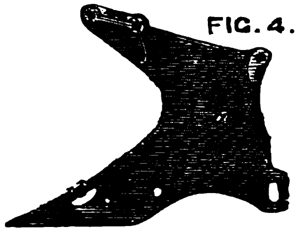


FIG. 2.

FIG. 3.

FIG. 4.



fixed to the beam *b*, and has secured to it the mould board, the slipe with the sole, and also the share, as is usual, but instead of being upright in relation to the sole, as usual, it inclines over from the sole towards the "furrow side" of the plough. The beam *b*, instead of being directly over the land edge of the sole, is brought more towards the furrow side, by which means a better balance and equilibrium is obtained in working than heretofore. *c* is the share, which fits on the nose of the frame or body of the plough; and *d* is a hooked rod or bolt, which passes into a hole in the share, and thence back

into an opening formed to receive it in the projection e of the frame, where it is tightened up by a nut; the projection e is also provided with a hole to receive a bolt for securing the hind part of the mould board. Another hole is formed in the frame or body a of the plough, for receiving the bolt which secures the forward part of the mould board.

The sole and slipe are cast together; this piece is connected to the body or frame by two bolts, one serving as a centre or axis, and the other passing through a slotted hole; this second bolt has an eccentric upon it, which bears upon a projection, so that by turning this eccentric round (when the nuts are slacked) the inclination of the sole can be varied.

THE STEAM PLOUGH ON PUBLIC TRIAL.

BY way of introduction to the Worcester trial-fields, and in order that our readers may rightly appreciate the status of steam culture at the approaching great competition of 1863, let us cite some of the main feats hitherto accomplished on such occasions.

Leaving out of view the ponderous steam-horse that used to "astonish the natives" with its lumbering tumbling "shoes," or "endless rails," and half-a-dozen ploughs following in its track; and omitting also, all notice of the travelling engine with rotary delver at its tail, which, first in one form and then in another, has from time to time surprised the public by bits of beautiful tillage that, unfortunately, never became anything more extensive than "bits;" and without devoting space to the mention of all the sets of wire-rope apparatus that have appeared at the Royal Meetings, we will just recapitulate a few of the principal facts reported by the judges concerning one or two of the best steam ploughs now before the world as candidates for public favour.

At the Chelmsford Meeting, in 1856, both Mr. Fowler and Mr. Smith of Woolston competed with machinery on the stationary engine principle. The rate of Mr. Smith's novel process of "smashing up" with a 7-horse portable steam-engine, was computed by the judges to be less than 4 acres in 10 hours, costing 8s. per acre for wear and tear, interest of capital, and all expenses. In the adjourned trial at Boxted Lodge, Mr. Fowler's engine, working up to 21-horse power, ploughed well at the rate of 7¼ acres in 10 hours, at a total cost of 7s. 2½d. per acre, including interest, wear and tear, and removal (which latter item was reckoned at no less than 17s. 6d., with a half-day lost every third day). This was for work valued at 7s. an acre by horse-labour.

In 1857, the steam-ploughing machinery was self-travelling from field to field (excepting in cases of very steep hills and unduly awkward turnings), and at the same time appeared the system of hauling an implement between a moveable engine on one headland, and a self-moving anchorage on the other. The work done was declared equal in excellence to good horse-ploughing; but the unsuitable nature of the ground precluded any satisfactory determination of the economy of performance.

Next year, at Chester, very marked progress was displayed. The Woolston cultivator, with stationary 8-horse portable engine and windlass, manufactured by Messrs Howard, broke up and then cross-scarified heavy land at the rate of 3½ acres in 10 hours (for the two operations); the total cost being 14s. per acre, for a condition of tilth that would have cost by horses at least 18s. 6d. Mr. Fowler's moveable 10-horse engine and anchorage ploughed light land at the rate of 7¼ acres in 10 hours; the total cost being 6s., instead of 8s. per acre, as by horses. The same machine ploughed "a strong three-horse soil" 6 in. deep, at the rate of five acres in 10 hours, at 9s. 2d., instead of 12s. 6d. per acre, as by horses—a saving of nearly 80 per cent. The interest and wear and tear were calculated at 20 per cent., divided over 200 days' work in a year; and the judges affirm that they charged each machine with a maximum of working expenses, while crediting it with a minimum value for the work performed. Double ploughing, or trenching 12 in. deep, was executed at the rate of 2¼ acres in 10 hours costing 18s. 4d. per acre; whereas horse-power could not have performed such perfect tillage at all, and by hand-labour it would have cost £6 13s. 4d. per acre, and yet have been inferior in value to the steam work.

At Warwick, in 1859, Messrs. Howard's Woolston apparatus "smashed up" in grand style a most obdurate piece of ground at the rate of 7 acres in 10 hours; and Mr. Fowler, with "digging breasts" attached to his three-furrow plough frame, "made a complete fallow of the hardest land at one operation," at the rate of 6¼ acres in 10 hours.

So far, perfection in the quality of the process had been attained; the point of economy was still open to further progress. A more systematic investigation of mechanical merits was instituted by the society's engineer and judges at Canterbury Meeting, in 1860, bringing out the following important results. In ploughing a strong loam (which, from the ascertained draught of a common plough at 6 cwt., would cost 12s. an acre if turned over by horses), "the least efficient of the competing machines (Beard's) showed a saving in total expense of 15 per cent.; both Robey and Co.'s and Eddington's machines showed a saving of 45 per cent.; and Mr. Fowler's work was done at a saving of no less than 68 per cent.," as compared with the cost by horse teams. Mr. Fowler's 12-horse engine, working with a pressure of 68 lb. on the square inch, drove four "3-horse furrows" at once, at the rate of 11 acres in 10 hours; and the total cost was computed to be 4s. 6d. an acre instead of 12s. (the lowest price by horse labour), though 20 per cent. upon the prime cost of the apparatus was allowed for interest and wear and tear. On the "strong land," where the draught of a single furrow represented the extraordinary traction-force of 7¾ horses, Mr. Fowler's machine ploughed up and down a hill having an average inclination of 1 in 10, in one place no less than 1 in 4½; the rate of performance being 6 acres in 10 hours, and the whole expense only 8s. 4d. per acre.

At these trials was also observed the time required for shifting engine and tackle, and "setting down" to a fresh field; about three-quarters of an hour elapsing between getting steam up to the pressure in one field and commencing tillage in another. This was a vast advance upon the "lost half-day" in 1856; and the engine being able to steam its own way from place to place, without the 6 or 8 horses previously needed, lowered the cost of removal to 4s., instead of 17s. 6d.

The prolonged Leeds trials in 1861 yielded a judges' report full of tabulated data and results. The principal feats were as follows. Mr. Fowler's 12-horse engine scarified at the rate of 6¼ acres in 10 hours, at a total cost of 7s. 2d. per acre, the depth being 7 in., and the soil very strong and stubborn. Messrs. Howards' 10-horse engine scarified the same soil 5¼ in. deep, at the rate of 6¾ acres in 10 hours, at a cost of 6s. 8d. per acre. It is impossible to place a money value upon this scarifying of whole ground into a deeply-pulverised seed bed at one operation, the bottom cleanly cut, the soil broken, and left light as by the spade; and further powdered and levelled, without the trampling of a horse, by a harrow hung loosely to one side of the grubbing or digging implement. The immense superiority of the tillage to any horse-work whatever was even more gratifying than the excellence of the regular turnover ploughing performed by the two most closely competing sets of apparatus. In the "heavy land" field, to plough a single furrow 8 in. deep required a draught equivalent to the power of five horses, yet Mr. Fowler's machine ploughed at that depth, at the rate of 5¼ acres in 10 hours, for the total cost of 7s. 10d. an acre. The most remarkable performance, however, was that of Mr. Fowler's stationary 8-horse engine and windlass, which ploughed a clover ley 6 in. deep, at the rate of 7¾ acres in 10 hours, the whole cost being 5s. 2d. per acre. The judges omitted from their calculation the expense of removal; but it was noted that while a "self-propelling" apparatus was "set down" and "loaded up again" ready for travelling for 4d. *per acre*, machinery demanding the assistance of four to six horses cost 9d. *an acre* for the same items of preparation for work.

The Farningham exhibition last year gave us no judges' investigation of the capabilities of the steam ploughs, but private observations made at the time are entirely at variance with the official announcement that the "cost of working, deduced from experiments at Boxted Lodge in 1856, is not now far from the truth." We have the authority of our own reporter (in the *Mark Lane Express* of that period) for the following statements. Messrs. Howard's stationary 10-horse engine, at 70 lb. pressure, ploughed at the rate of about 7¼ acres in 10 hours, and Mr. Fowler's moveable 14-horse engine, at 40 to 50 lb. pressure, ploughed at the rate of about 9 acres in 10 hours. This was a fair 3-horse work for a single furrow (as apparent from the depth and from the character of the land), worth at least 10s. per acre by the horse-plough, and estimating the expenses by the table in the Leeds report, the cost was from 6s. down to 5s. per acre. Mr. Fowler's moveable 10-horse engine, at 60 to 70 lb. pressure, also accomplished 7½ in. deep "digging" at the rate of about 12 acres in 10 hours, the cost probably under 4s. an acre; and his 14-horse engine scarified at the rate of about 30 acres in 10 hours, at a total expense of less than 2s. per acre—up to that time an unprecedented feat in steam cultivation. One lesson of the Leeds trials had been that very considerable motive power was economised by efficiently carrying the wire rope clear of the ground. An experiment there made showed that the draught of a length of rope trailing along the land was ten times greater than when the same rope ran over rope-porters, holding it clear of the ground; and, accordingly, at Farningham, Messrs. Howard, as well as Mr. Fowler, appeared with mechanism for tightening and upholding the "slack" rope.

Of the Yorkshire Agricultural Society's steam cultivation trials, in August, 1862, Mr. J. C. Morton furnished a very comprehensive report from which we glean the following main points. On a foul clover stubble, in light sandy soil (a small part hard clay), Mr. Fowler's single-cylinder 8-horse engine, working at probably 70 lb. pressure, ploughed 5 in. deep, at the rate of 10 acres in 10 hours. Where the proportion of clay was somewhat greater, Messrs. Howards' double-cylinder 10-horse power engine, at 70 lb. pressure, ploughed full 5 in. deep, at the rate of 7¼ acres for 10 hours.

A new method of comparing the work made by cultivators or scarifiers was tried on this occasion. A frame, 4 ft. by 4½ ft., inclosing an area of two square yards, was dropped here and there upon the several plots of work done, and the loose earth within the frame carefully collected and weighed. Messrs. Howard's 10-horse engine moved 680 tons weight per acre, at the rate of one acre, or 660 tons per hour. Mr. Fowler's 14-horse engine moved 650 tons per acre, at the rate of 1¾ acres, or 1,240 tons per hour, the daily work 18¾ acres. Though the weight moved per acre was less than in Messrs. Howard's case, Mr. Morton observes that the soil was completely tossed about by the high speed of the implement; whereas the Bedford cultivator merely moved what it broke up, so that a crossing would be required to make its tillage equal to that of the former. In fact, the weight of loosened earth per square yard or acre is a test of the depth of work, but by no means of the efficiency of the mechanical action to which the ground has been subjected.

In May and June last, Messrs. J. C. Morton and J. T. Harrison, C.E., conducted a series of dynamometer experiments with the Woolston, Leeds, and Bedford machinery. Their report having been but recently published in our columns, a word or two here will be sufficient. The circumstances of the trial can hardly enable us to draw a just comparison between the several machines. The Woolston tackle was not new, and was worked with comparatively few rope-porters. It does not appear, from the experiments with the Bedford tackle, how much of the draught of the slack-rope is returned again to the pulling-rope, by means of the compensating pulley on the double snatch-block. The data respecting the Leeds tackle seem ample enough, with one exception—the friction due to the anchorage pulley when the whole strain is on the rope was not ascertained. It is very remarkable that only three-quarters of a hundred-weight draught was needed in order to move 700 yards length of rope passing round and distended between the engine clip-drum and the anchorage pulley, and carried clear off the ground upon rope-porters. A 1 cwt. draught, at a speed of three and a half miles per hour, represents 1-horse power, the waste of motive power between the engine and the implement is, therefore, very small indeed.

We await now the Worcester trials, where perhaps a further investigation of mechanical merits and defaults will be made by the Royal Society's engineers.—*Mark Lane Express.*

The Government of India has sanctioned the sum of Rs. 2,48,738 for establishing telegraphic lines from Rajmahal *via* Maldah and Dinagepoor to Gowhatty, with a branch from Gowhatty to Sylhet and Cachar.

The American steam fire engine, "Manhattan," which was so severely injured by the accident at the Crystal Palace as to be unable to compete in the late trial, has now been repaired, and is to be publicly displayed at work in the grounds of the New River Company, at New River Head, Clerkenwell, on Saturday next, the 25th inst., at twelve o'clock noon. Very great interest is felt in scientific circles as to the capabilities of this celebr[illegible] machine, which is reputed to be the most [illegible] ful and efficie[illegible] the American [illegible] engines.

MERRYWEATHER AND FIELD'S IMPROVEMENTS IN STEAM FIRE-ENGINES.

Fig. 1.

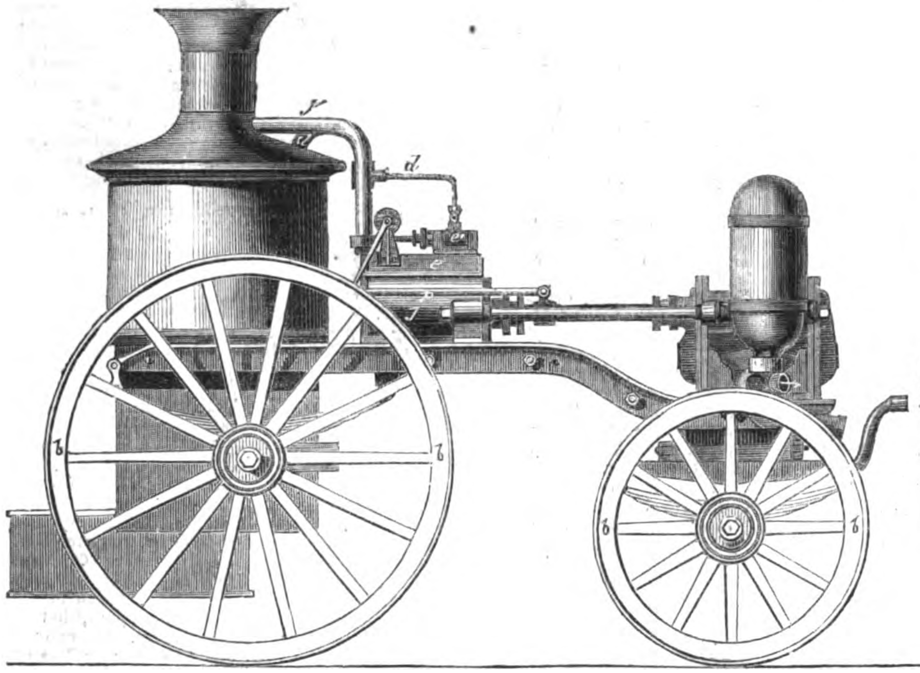
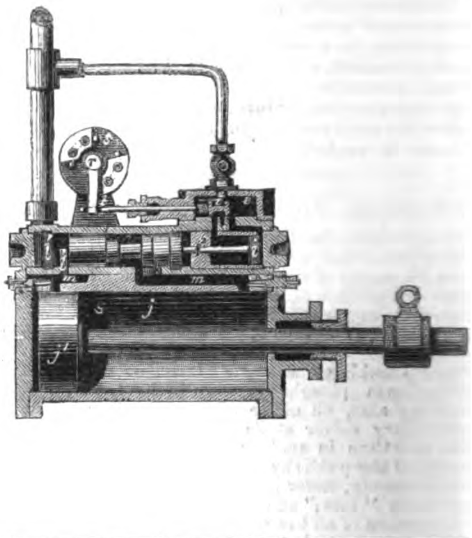


Fig. 2.



MERRYWEATHER AND FIELD'S IMPROVEMENTS IN STEAM FIRE-ENGINES.

The following inventions for improvements in steam fire-engines have been patented recently by Messrs. Merryweather and Field, and may be described as follows:—

The improved steam fire-engine consists of a framed carriage, mounted when intended for land service, on travelling wheels; at the hinder end of the frame is a boiler, in front of which is placed the steam cylinder and pump. The boiler consists of a vertical fire-box with water and steam chamber above, from the lower plate of which descend a number of tubes arranged around the entrance to the smoke flue, the lower ends of some of them converging inwards to bring them into more immediate contact with the main body of the fire. Within these tubes are smaller ones open at top and bottom, their upper ends being wide-mouthed or trumpet-shaped to facilitate the entrance and downward passage of currents of solid water, unaffected by the steam which rises externally around them. The exhaust pipe from the steam cylinder on entering the chimney passes downward to a chamber (the lower surface of which forms a baffle plate) from whence the steam is projected upwards to increase the draught in the fire-box. Provision is made for cushioning the piston in the steam cylinder, by causing it to pass beyond and close the main ports, the steam and exhaust being then led through a smaller channel capable of nice adjustment. Steam is admitted to the working cylinder of the engine by a slide valve, acted upon by a smaller steam valve which receives its motion from connecting rods attached to the piston rod of the engine.

Fig. 1 is an elevation of a single cylinder steam fire-engine for land service, constructed according to this invention; and fig. 2 is a vertical longitudinal section of the steam cylinder and valves appertaining thereto. The framing of the machine *a*, *a*, is formed principally of angle iron supported on springs, and carried by the travelling wheels *b*. The boiler *c* is attached to and carried by the framing at a level below the steam and water spaces, so that the bolts employed for fixing do not pass into either of them, thus avoiding liability to leakage. It communicates by the steam pipe *d* with the valve chest *e*, as also by a small pipe d^1 with the valve chest e^1, made use of for regulating the motion of the piston valve, whereby the ingress and egress of steam to and from the main cylinder are regulated. The construction of the cylinder and valves is clearly shown at fig. 2, in which the same letters are employed to indicate the same parts as in the other figures. The two pistons f, f^1, of a piston valve work in a suitable cylindrical valve chamber or chest *e*, into which steam is led from the steam pipe *d*. The rod f^2 of the piston valve is continued forward, and fitted with a small piston *i* working in a cylinder, to which steam is admitted alternately on each side of the piston as required by means of a small slide valve i^2 of ordinary construction. The valve chamber *e* communicates with the main cylinder *j* by means of four passages k, k^1, and l, l^1, which open into thoroughfares m, m^1, communicating respectively with the forward and backward ends of the cylinder. Small passages n, n_1, lead into the main thoroughfares m, m_1, and are formed with cocks for the purpose of regulating the escape of steam after cushioning. The action of the valve piston is regulated by means of levers o, o^1, connected by links p, p^1, with the piston rod, common to both the steam cylinder *j* and pump *q*. The levers o, o^1, communicate motion to a rocking shaft *r*, upon which is keyed a disc *s*, fitted with adjustable stops, which act alternately upon each side of a tongue lever *t*, taking into the rod of the slide i^2. In the position of the parts as shown, the piston j^1, propelled by steam (admitted through the opening *k* to its forward side), has just completed its backward stroke, and by closing the backward main port has caused the steam behind the piston to form a cushion, whereby the momentum of the piston has been checked sufficiently to avoid injury to the end or cover of the cylinder; while the steam forming the cushion has, at the same time, been gradually escaping through the opening *n* into the exhaust passage l^1. The piston rod during its backward action has given motion in that direction to the levers o, o^1, the shaft *r*, and disc *s*; the latter moving through a great portion of its arc without moving the tongue lever *t*. When, however, the corresponding adjustable stop has come into contact with the forward side of the tongue lever, the slide i^2 is immediately moved into the position shown, and steam is thereby admitted to the forward side of the small piston *i*, thus driving it backward, and carrying the pistons f, f^1, into the position shown by the dotted lines, and causing the piston j^1 to be moved in the contrary or forward direction; firstly, by the passage of steam through the small passage *n* to the back of the piston, which, upon passing, and thus laying open the back port, is continued in its forward motion by the full volume of steam entering thereby, until upon the piston *j* arriving near to its forward stroke, the piston *i* is again moved, and the contrary action takes place. It is obvious that the frame, boiler, and general arrangement herein represented and described with reference to this engine may also be applied to engines having two or more cylinders and pumps.

Fig. 3 is a vertical section of the boiler; and fig. 4, an enlarged section of one pair of the tubes detached. The fire-grate is of the ordinary or any other suitable construction, and is enclosed in a casing *v* depending from the water and steam space u, u_1. From the tube plate *x* depend and descend into the furnace a series of tubes x^1, curved or otherwise as found most convenient for the economical employment of the heat generated in the furnace. These tubes x^1 contain other tubes x^2, which are notched or otherwise made so as to be freely open at bottom, and are formed with enlarged trumpet-mouths at their upper ends, or are otherwise equivalently shaped, to deflect the steam and water ascending from the annular spaces contained between the inner and outer tubes, in such manner as to facilitate and not to interfere with the downward current of colder and solid water, descending by the inner tube to replenish that which has passed upward by evaporation or otherwise between the inner and outer tubes. This deflection of the upward current may be effected by various arrangements, differing more or less from the trumpet-mouth hereinbefore described and shown; as for example, by the use of a dish or cup-shaped top to the inner tube, or by an annular disc or washer, both of which are substantially equivalent to the trumpet-mouth.

The steam, after passing through the engine, as described, is carried off by an exhaust pipe *y*, which terminates in a box or chest y^1, having an opening opposite to the bottom of the chimney; from which opening the steam rushes upward, and increases the draught of air through the fire-grate; the lower side or surface of the box or chest acting at the same time as a baffle plate, deflecting the flame and heated gases, and preventing their too rapid escape up the chimney. The circumference of the tube plate *x* is bent downward so as to form an annular pocket x^3 for the collection of mud or sediment thrown up and ejected from the tubes, and which, after settling in the pocket, may be got rid of when required by openings provided for that purpose.

MERRYWEATHER AND FIELD'S IMPROVEMENTS IN STEAM FIRE-ENGINES.

FIG. 3.

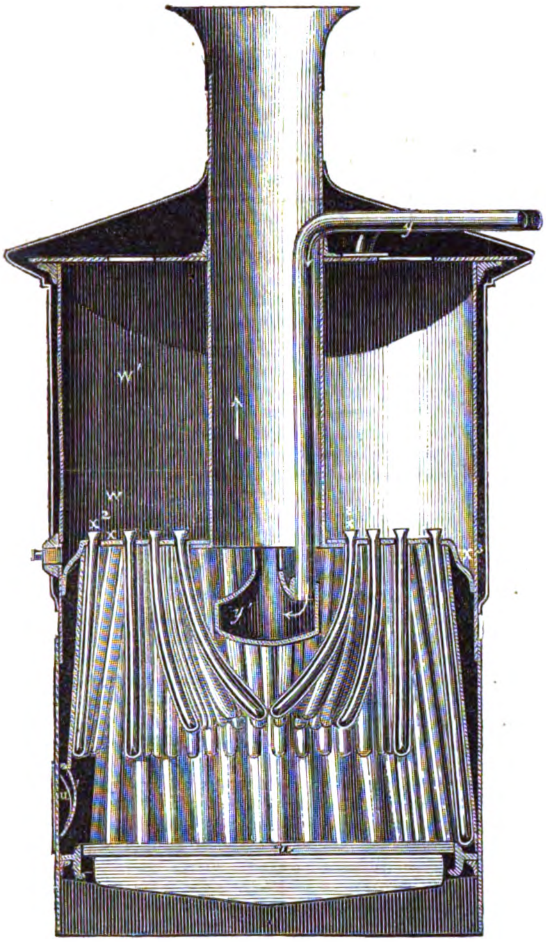


FIG. 4.

OILING WOOL BY MACHINERY.

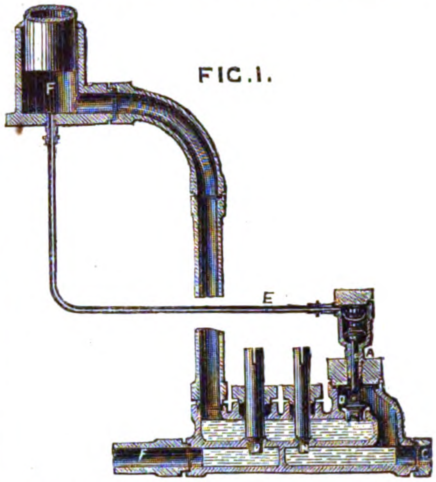
WE have had an opportunity of inspecting an invention by Mr. Leach, of the firm of Messrs. Littles, Leach, and Co., Britannia Mills, Leeds, which appears effectually to meet a requirement long felt in the woollen trade. In order to render wool more workable than it is in its native state, it is customary to oil it, a process which has the effect of causing the fibres to slip more readily and evenly, and ensures more perfect cording and regular yarn. Hitherto the oil has been distributed by hand from a syringe, watering-can, or similar instrument; and the result has been that the oil has been diffused very irregularly, in some places the wool being saturated and clotted, and in others escaping altogether. This inequality in the oiling of the wool produces similar inequality in the yarn, and the defects of the process are discernible in the various stages of manufacture. It is to obviate this difficulty that Mr. Leach's invention is intended. The invention has the advantage of being readily attached to willies, teazers, pluckers, burring, and other machines employed in the manufacture of wool, and is so constructed that it can distribute oil to any given extent, the machine measuring and distributing the liquid with unerring accuracy. As the wool passes along the feed-sheet of the preparing machine, the oil is, by means of the apparatus invented by Mr. Leach, scattered over it in the form of a spray or mist; and on examination afterwards we found that the wool was thoroughly oiled, a fact which could be detected by feeling the wool; but the oil having been so evenly and accurately distributed, was not perceptible to the eye. The quantity of oil can be varied at pleasure, and, by a simple arrangement, it can be conveyed to the machine in pipes from the cask or cistern, thus saving much labour and preventing waste. An invention of so much importance to the woollen trade, notwithstanding that it is said to be slow in adopting improvements in machinery, cannot fail to be universally acceptable.—*Leeds Mercury*.

BROWN'S HYDRAULIC PRESS.

A PATENT has just been obtained for an invention by Mr. J. Brown, of Sidney-street, E., for improvements in hydraulic machinery. The invention consists of a box containing a piston for the prevention of accidents in hydraulic machinery in the event of the main pressure, pipe breaking or engine stopping. This box as placed above the relief valve now in use, connecting the box by means of a pipe to the lifting cylinder or cylinders. In the event of the main pressure, pipe breaking or engine stopping, the pressure contained in the lifting cylinder or cylinders will at once act on the piston and cause the rod thereof to press upon the relief valve, thereby preventing the water escaping from the lifting cylinder or cylinders, and thus stop the running down of any weight the machinery may be lifting. The box and piston may be fixed at any other convenient place instead of above the relief valve now in use; but in such cases the piston rod has a mitre stop valve or clack fitted to it, which will act in the seat of the piston box and have the effect as above described.

The piston box A is shown as being fixed above the relief valve D, and connected by means of the

FIG. 1.



pipe E with the lifting cylinder F, in order that the pressure existing in the lifting cylinder may cause the rod of the piston B to descend and press upon the relief valve D whenever the pressure should be taken off the said relief valve D, either through the engine stopping or the breaking of the main pressure-pipe C. Another piston box G, fig. 2, may be used and fixed at

FIG. 2.

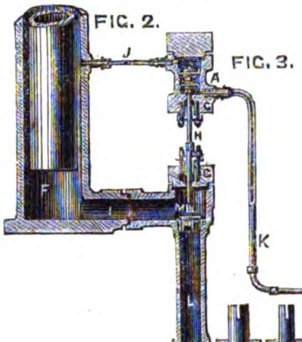


FIG. 3.

any other place than above the relief valve, and even used where there is no relief valve. This piston box G is connected with the lifting cylinder F by means of the pipe, I and J, connecting also said piston box G directly with the connetcion pipe L, and by means of the pipe K connecting the piston box G further with the main pressure, pipe C. The piston rod of the piston H carries a valve M, which is always kept in a lifted position by means of the pressure conveyed by the pipe K from the main pressure-pipe C to the piston H, thereby allowing the water to enter the lifting cylinder F or to run out of the same so long as no accidents happen; but as soon as the engine should stop whilst in the act of lifting, or the main pressure-pipe C break, then, the pressure ceasing to exist in the pipe K, the piston H would instantaneously descend by means of the pressure existing in the lifting cylinder F, which pressure would then be conveyed to the said piston H by means of the pipe J, and the valve M fixed to the rod of the piston

H would at once prevent the water running out of the lifting cylinder F, and the weight then being lifted would remain stationary. The pressure-valve N is used for the purpose of allowing the water to enter from the main pressure-pipe C into the lifting cylinder F; and the exhaust valve O, is used to discharge the water from the lifting cylinder F by means of the pipe P. Fig. 2 represents the piston H and valve M in the position it would be in the event of the engine stopping or main pressure-pipe C breaking.

RULES FOR THE CONSTRUCTION OF BLOWING FANS.

We have extracted the following remarks on this rather important subject from a French scientific publication.

Carefully-conducted experiments have demonstrated the accuracy of the following rules :—

The length of the blades or vanes should be equal to, or slightly greater than, half the radius of the complete fan.

When the air gains access to them on each side, their width should be a little greater than one-half the diameter of the orifice through which it enters. When the air is admitted to the fan-case at one side only, this width should be diminished by one-half.

The fan-blades should be inclined in the direction of their motion in such a way as to form an angle of about 18 deg. with a radius line passing through their inner extremities. The apertures for the entrance of the air should form circles a little larger than that described by the inner ends of the blades. They should be slightly eccentrical to the fan-shaft, inclining towards the delivery-trunk.

It is of the last importance that the fan should be carefully centred, and accurately balanced.

The noise usually produced by these machines may be somewhat diminished, by fitting a kind of trumpet-mouth of sheet iron to the central orifice.

They are best made without spokes or arms, by rivetting half-vanes on each side of a central disc.

REMARKABLE CHANGE OF FORM IN METALS.

Lieutenant-Colonel H. Clerk has contributed a Paper on the above to the last number of the Proceedings of the Royal Society. He was led to conduct some experiments on the subject by the following circumstance :—When, a short time ago, the workmen at the Royal Arsenal, Woolwich, were about to shoe a wheel with a hoop-tyre, to which it was necessary to give a bevel of about three-eights of an inch, one of the men suggested that the bevel could be given by heating the tyre red-hot and then immersing it one-half its depth in cold water. This was tried and found to answer perfectly; that portion of the tyre which was out of the water being reduced in diameter. The tyre was 3 in. wide, ½ in. thick, and 4 ft. 2 in. in diameter. As this result was curious and not generally known, Colonel Clerk considered it desirable to institute some further experiments, in order to try how far, by successive heatings and coolings, this change of form could be augmented, and also whether the same effect could be produced on other metals than wrought iron. The experiments were made on cylinders of wrought iron of different dimensions, both hollow and solid—immersed some to one-half of their depth, others to two-thirds; also on similar cylinders of cast iron, steel, tin, zinc, and gun-metal. With wrought-iron the heatings and castings could be repeated from fifteen to twenty times before the metal showed any signs of separation; but with cast iron, after the fifth heating, the metal was cracked; and the hollow cylinder separated all round just below the water line, after the second heating. Cast steel stood twenty heatings, but was very much cracked all over its surface. As respects the change of form of cast iron and steel, the result was similar to that in wrought iron, but not nearly so large in amount. The cast iron did not return to its original dimensions; but the smallest diameter was about 1 in. above the water line. Tin showed no change of form, there being apparently no intermediate state between the melting point and absolute solidity. Brass, gun-metal, and zinc showed the effect slightly; but instead of a contraction just above the water line, there was an expansion or bulging.

THE MAIN DRAINAGE OF LONDON.

The Main Drainage works were visited on Saturday last by a large number of distinguished persons. The *Times* shortly describes Mr. Bazalgette's scheme in the following words:—This great plan may best be briefly described as consisting of three gigantic main tunnels or sewers on each side of the river. These completely divide underground London from west to east, and, cutting all existing sewers at right angles, intercept their flow to the Thames, and carry every gallon of London sewage, under certain conditions, into the river on the north side below Barking, and on the south to near Erith. These main drains are called the high, middle, and low level sewers, according to the height of the localities which each respectively drains. The high level on the north side is about eight miles in length, and runs from Hampstead to Bow, being at its rise only 4 ft. 6 in. in diameter, and thence increasing in circumference, as the waters of the sewers it intercepts require a wider course, to 5 ft., 6 ft., 7 ft., 10 ft. 6 in., 11 ft. 6 in., and at its termination, near Lea river, to 12 ft. 6 in. in diameter. This drain is entirely finished, and in full work. Its minimum fall is 2 ft. in the mile; its maximum at the beginning nearly 50 ft. a mile. It is laid at a depth of from 20 ft. to 26 ft. below the ground, and drains an area of fourteen square miles. The middle level, as being lower in the valley on the slope of which London is built, is laid at a greater depth, varying from 30 ft. to 36 ft., and even more below the surface. This is nearly complete, and extends from Kensal Green to Bow. The low level will extend from Cremorne to Abbey Mills, on the marshes near Stratford. At Bow the low level waters will be raised by powerful engines at a pumping station to the junction of the high and middle level ducts, thence descending, by their own gravity, through three tunnels to the main reservoir and final outfall below Barking. These three tunnels are each 9 ft. 6 in. in diameter, and nearly four miles long. Great engineering difficulties existed in the construction of these main arteries, as, from the height at which they all meet, it was necessary to take them above the level of the marshes leading to Barking. For a mile and a-half the embankment which encloses the three tunnels is carried on brick arches, the piers going 18 ft. below the surface, and being based on solid concrete. In the marshes at Barking the reservoir for the reception of the sewage of the north side is formed. This reservoir is a mile and a-half long by 100 ft. wide, and 21 ft. deep. It is made of this great length in proportion to width to allow of its being roofed with brick arches, which are again covered with earth to a considerable thickness, so that not the slightest smell or escape of miasma can take place. This is capable of containing more than three times the amount of sewage which can enter it while the pipes are shut, and thus, when all is complete, the works will not only be large enough to take off all London's sewage now, but its sewage when in London is double its present size. While the sewage is in the reservoir we have spoken of, it will be completely deodorised by an admixture of lime. When the tide is at its height, the sluices which pass from the bottom of the reservoir far out into the bed of the river will be opened, and the whole allowed to flow away. It takes two hours thus to empty the reservoir, by which time the tide will be flowing down strongly, and will carry its very last gallon a distance of thirteen miles below Barking, which, being itself thirteen miles below London, will place the contents of the sewers, every twelve hours, twenty-six or more miles distant from the metropolis. Thus, instead of letting loose the rankest of this great city's abominations in the very midst of London, and leaving it to stagnate, or, still worse, to be agitated backwards and forwards in a small body of water, it will all be carried away a distance of thirteen miles, then deodorized, then suffered to escape into a body of water more than a hundred times greater than that into which it now crawls, and thus disinfected and diluted, so as to be without either taste or smell, swept still further down the stream, till every trace of it is lost. On the south side the three great sewer arteries are constructed on similar plans—the high level from Dulwich to Deptford; the middle from Clapham to Deptford; and the low level from Putney to Deptford. At this point is a pumping station, which raises the water from the low to the high level, whence it flows away through a 10 ft. tunnel to Crossness Point. One part of this tunnel, passing under Woolwich, is a mile and a-half in length, without a single break, and driven at a depth of 80 ft. from the surface. At the outfall will be another pumping station, to lift the water to the reservoir. The southern reservoir is only five acres in extent; that on the north is 14. In the reservoir it will be deodorized and discharged in a similar way to that we have already described.

It was over these last-named works, amid an apparently inextricable labyrinth of culverts, arcades, chambers, and columns, that the visitors were conducted, first inspecting the channel for the overflow of storm-water, next the two culverts, as large almost as railway tunnels, which carry the sewage to the east and west pumping stations. Before the entrance to the pumps are massive iron strainers, which keep out all the coarse refuse brought down the sewer, and which is afterwards dredged up by the filth-hoist into the filth chamber, which is flushed into the river at low water. The pumping-house is nearly finished, and the iron-work of the engines begun. The pumping stations will each consist of an engine-house, containing ten boilers calculated to work up to 500-horse power nominal. This power working through eight pumps of 7 ft. diameter and 4 ft. stroke will daily raise 19,000,000 cubic ft. of sewage from 19 ft. below low water to the level of the outfall; but, in case of necessity, the pumps can raise 25,000,000 ft. per day. The reservoir into which it will all flow is not yet finished, but when roofed in with brick will hold 20,000,000 gallons of sewage. After inspecting these works on Saturday the visitors were taken across the river to the Barking outfall, where the works are larger, simpler, and much more advanced, for on the north the sewage is brought at such a level as to discharge into the reservoir by its own gravitation. The reservoir here is far advanced, a great deal of it being roofed in, so that it will all be completed in a few months more. Close to this the contents of the high level sewer were turned on into the river direct, and not as they will in future flow, through the reservoir. The inspection of this murky Niagara of sewage, as it came tumbling down, seemed to be not at all unpleasant to members who are accustomed to legislate in hot weather on the banks of the largest sewer in the world—the Thames. After gazing on this unsavoury volume of dirt for some time, by way of an appetiser, the whole party returned to the great reservoir to lunch. In the afternoon the visitors returned to town, having enjoyed an agreeable, and, we may add, an instructive excursion.

The total strength of the three rows of intercepting sewers, the course of which we have sketched on each side of the river, will be fifty miles, and before all the works are completed 800,000 cubic yards of concrete will be consumed, upwards of 300,000,000 of bricks, and 4,000,000 cubic yards of earthwork.

M. Rouher has obtained the signature to a decree directing that a Universal Exhibition shall be held in Paris in 1867, opening on the 1st of May and closing on the 1st of October.

TO CORRESPONDENTS.

HENRY KERR.—Your letter is too long for insertion. It lies at our office for you.

E. T.—Your invention is simple and ingenious.

W. G. F. (Stockton.)—Write to the Secretary Gt. George-street, Westminster.

RECEIVED.—W. F., W. B., H. K., E. T., W. G. F.

W. F.—We have no doubt that you will learn with some surprise, that your invention has been patented in precisely the same form you propose years ago.

D. K.—We have not as yet been able to get accurate replies to the questions you wish answered.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

STEAM FIRE-ENGINES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Having seen Messrs. Lee and Co.'s challenge, I beg to say that I am willing to meet them or the makers of any American steam fire-engines, or the makers of any English steam fire-engines with or without American improvements, in *fair* competition.

But, as weight is not the only property of a good fire-engine, I respectfully suggest that the following points should be taken into consideration at any future trials, viz:—

Adaptability for rapid travelling over rough roads and turning sharp corners.

Capability for carrying men, hose, ladders, and other gear.

Facility of raising and generating steam.

Facility of drawing water from depths, without priming or charging pumps or pipes, or inserting foot valves in the suction pipes.

Quantity delivered at various pressures, or through various sized nose pipes as compared with the theoretical capacity of pumps.

Simplicity of construction; accessibility to the various parts of engine, pump, or boiler; and lastly,

Cost at which it can be produced.

Should these conditions be accepted, I am quite willing to produce my engine, the "Princess of Wales" (the one that was too heavy for the class it was intended for, had to work against engines four or five times its power, and was highly commended at the late trial), at such time and place, and for such sum as may be agreed upon between us.

WM. ROBERTS.

Millwall, July 21, 1863.

RAILWAY ACCIDENTS, AND THEIR CAUSES.

SIR,—I have read with much interest the article on "Railway Accidents," and hope the subject, which is one of great importance, will meet with due consideration from engineers and directors, so as to reduce the number of what may fairly be considered avoidable accidents, or rather damages to railways, which proper care and precaution will lessen if not wholly prevent. I feel assured—after thirty years of working practically amongst the railways of England—that the care of the permanent way and its safe gauge, on which all its true working depends, is too much in the hands of simple labouring men, who are neither sufficiently nor efficiently superintended or directed, in their work of repairing or relaying permanent ways. Another point is the too frequent taking up and relaying of sleepers of permanent way—consequent on their quick and in some cases rapid decay and rotting—and the great risks of accidents consequent to the same, and which often leads to imperfect gauges being laid, owing to the hurried nature of the work and inefficient inspection. The time is not far distant when "permanent ways" will be really so in work as well as in name; but where wood sleepers, and inferior of their kind, are now often introduced on railways for (so called) economy, it cannot be permanent in any way or sense; and the gauge or width-space of rail paths, and space between, should be at all times uniform throughout to secure safety in "quick speeds" which is the desideratum.

Yours respectfully,

PRACTICAL.

Miscellanea.

It is stated that after a rather protracted inquiry the Government have assented to the proposal of Mr. Cave, M.P., chairman of the West India Committee, and agreed to remit the Customs' duty on methylated rum, in order that it may be used as a desiccant for paint in the same manner as spirits of turpentine, the price of which has been seriously enhanced by the American war. The methylation is to be performed in bond, and the differential duty of 2d. on colonial, and 5d. on foreign spirit, imposed for the protection of the British distiller, is still to be paid.

The *Times'* Correspondence of yesterday contains a valuable letter on boiler explosions. The views enunciated by the writer are in accordance with our own, expressed a couple of weeks ago. While advocating careful inspection, however, the writer proposes that it shall be accomplished by the formation of voluntary associations, rather than by Government interference.

Mr. Milholand, of the Reading Railroad, U.S., once proposed to light his workshops, employing 700 men, with gas made from old greasy cotton waste, &c. The proposed apparatus would have cost about £250; and we have little doubt the scheme was quite practicable.

Divers have walked more than a mile under water 100 ft. deep.

Cast steel slide valves have been often used in locomotives.

The use of caloric engines of small size seems to extend slowly in America. These machines possess many advantages where but a trifling amount of power is required.

Japanese coal measures about 37 cubic feet to the ton. It is extremely smoky, contains little sulphur, and forms in burning from 40 to 50 per cent. by bulk of clinker. It evaporates 4·5 lb. of water for each pound consumed in a marine boiler of ordinary construction. We do not imagine that it will ever prove of much service to our Navy.

We learn from *Le Monde* that a submarine vessel, "Le Plongeur," has just completed a very successful voyage from Rochefort to the Island of Aix, under the command of Captain Bourgois, who designed the boat. This first experiment has proved the regular working of the machine under the action of compressed air, the ease with which the crew can live and work in an artificial atmosphere, and the rapidity and ease with which the boat can be manœuvred. In a few days all will be ready for definite trials, from which the happiest results are expected.

A trial trip of a new despatch steamer or *aviso*, lately built by Messrs. Money Wigram and Penn, for the Italian Government, took place on Monday. The new boat, which is constructed on similar lines to one built by the same firm for the King of Italy a few months since, is 250 ft. in length between perpendiculars, 30ft. in breadth, and carries engines of 350-horse power. They are of 5 ft. stroke, and their cylinders are 71 in. in diameter. The paddle-wheels are over 23 ft. in diameter and are fitted with feathering floats. As in most boats constructed by Messrs. Penn, the engines are oscillating, and the boilers are on the tubular system. The trip extended from Tilbury Fort, to a little beyond Sea Reach, and the speed attained in running the measured mile was at the rate of 17 knots, or 19·6 miles an hour. As the "Messaggiere" starts for Genoa, she had already taken on board over 180 tons of coal, besides nearly the same amount of stores and spare gear, which caused her to draw almost a foot more water than she would have done under ordinary circumstances. With a normal load there appears to be little doubt of her running at a speed of 17¼ or even 17½ knots an hour—a swiftness hardly ever yet gained by the fastest of the many fast boats launched from Messrs. Penn's yard.

A Newcastle paper states that a novel lifeboat, the building of which was commenced at Tow Law, on the 10th of March, is now nearly ready for sea. The builder is a working man, which may partly account for the delay that has taken place in the completion of the undertaking. The boat is almost wholly composed of iron, and she is expected to be self-righting, being arched over the top with sheet iron, and propelled by three screws, one of which lies midships, so that the quick heaving to which lifeboats are subjected cannot throw the screw out of the water unless she turn keel up. Her length is 15 ft. by 4 ft. 2 in. broad. The screws are to be driven with levers, so as to imitate the motion of rowing with oars, which boatmen are daily used to. The boat is now lying at Washington.

The following appeared in yesterday's *Times*:—Two hundred tons of armour-plates are now being delivered at Portsmouth Dockyard by vessels from France, the manufacturers being Messrs. Petin, Gaudet, and Co., the makers of the armour-plates for the frigate "La Gloire," and the other iron-clads in the French Imperial Marine. 100 tons are of 4½ in., and have been purchased by our Admiralty at £45 per ton. The remaining 100 tons are of 5½ in., the price being £50 per ton. Like all the other French plates which have been supplied to the English Government, these from Petin, Gaudet, and Co., have a very rough, blistered, and unfinished appearance; but this may not detract at all from their cohesiveness or shot-resisting power. They are, however, such plates as the Admiralty would not receive on any terms from English manufacturers. The latter, indeed, are loud in their complaints, and have been now for some time past, of the restrictions the Admiralty place upon them in compelling them to give their plates such a perfectly even surface, and to bestow upon them such an immense amount of "trimming and polishing." They say that the plate is ruined in its defensive quality as ships' armour, and that they therefore do not compete with the French makers on equal terms. In the previous trials of plates at Portsmouth, furnished by Messrs. Petin, Gaudet, and Co., and M. Schencking, of Toulon, the plates themselves, although roughly manufactured, showed an extraordinary degree of resisting power to the 68 lb. solid shot at 200 yards range, and the metal of which they were composed was evidently of a very superior quality.—Competition is all very well; but our own iron manufacturers should take some steps to see that in this case, at least, it is conducted on principles of perfect equality.—ED. M. M.

Mr. T. Collins sends us the following:—"In your last number is a paragraph reporting some remarks of Mr. B. Cochrane, in the House of Commons, on the proposed Lighthouse at Great Bass Rocks, Ceylon. I happen to know something of this matter, the most mismanaged I ever heard of. I went out in March, 1856, to Ceylon in the same vessel as the engineer, a very young and erratic, though pleasant fellow: the subject being very interesting to all naval and travelling people, he displayed his plans and explained them—the drawing exhibited an iron lighthouse, with granite substructure, let in some feet into the Bass Rock; all was settled as to the erection, but he candidly acknowledged that the rock had not been surveyed for 8 years, and that no regular report had even then been made, the "account" of the liable authorities and fragmentary information being all that was available. "Whether the rock was of granite was rather uncertain, it was supposed to be 8 ft. above (tranquil) water at its highest point, its extent was probably diminished, and the possibility of excavation for building of course not known." This was his statement, and all turned out wrong, the rock would not take the building, and any operations at all on it, even at the best seasons, were almost impracticable. When I left the island in 1858, I saw the engineer again, and he told me (what everybody there knew) that beyond imperfect surveying and abortive attempts to work the rocks, nothing had been done. A wretched steamer had been bought, and was found useless, and he was waiting more means. Since then nothing of moment seems to have been accomplished in this most important matter. I may finish by informing you that an English vessel was wrecked on the Basses while I was in Ceylon."

Mr. Grove, F.R.S., has delivered a lecture before the Chemical Society, describing his researches on the action of heat on liquids. Amongst others, he mentions the following experiment:—A long glass tube, closed at one extremity, was bent in the middle nearly to a right angle; the closed limb was then half-filled with water, from which, by long boiling, the air was supposed to have been expelled; the remaining space in the tube was then completely filled with olive oil, and the opened extremity dipped into a basin of the same. Heat was then applied to the tube until the water boiled, and this temperature maintained for a considerable time. Each bubble of steam which left the surface of the water passed through the column of oil, becoming smaller and smaller during its ascent; but never did it condense without leaving a microscopic bubble of gas, which at length accumulated so that it could be examined. This bubble was found to be pure nitrogen. Similar experiments were made with bromine, chloride of iodine, &c. The general conclusion Mr. Grove derived from his experiments was to the effect that water had a very powerful affinity for the gases of the atmosphere; that, by several processes, the oxygen could be eliminated, but that the nitrogen resisted all attempts to expel

it from solution—so much so, that it might be doubted whether chemically pure water (a compound of two elements only) had ever been prepared; and, further, that ebullition (as applied to water) under all circumstances, consisted merely in the production and disengagement of bubbles of aqueous vapour formed upon a nucleus of permanent gas.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 3354.
Boilers and Furnaces, 3384.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3352.
Ships and Boats, including their fittings, 3361, 3403.
Cultivation of the Soil, including agricultural implements and machines, 3376, 3377.
Food and Beverages, including apparatus for preparing food for men and animals, 3396.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 3355, 3359, 3360, 3366, 3373, 3383, 3385, 3388, 3392, 3394, 3395, 3401, 3407, 3409.
Buildings and Building Materials—none.
Lighting, Heating, and Ventilating, 3353, 3363, 3368, 3371, 3380, 3382, 3391, 3405.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 3349, 3356, 3357, 3358, 3364, 3378, 3379, 3400, 3402, 3406.
Metals, including apparatus for their manufacture, 3351, 3375, 3397, 3398.
Chemistry and Photography, 3387, 3389, 3400.
Electrical Apparatus—none.
Warfare, 3367, 3399, 3404.
Letter-Press Printing, 3365.
Miscellaneous, 3350, 3361, 3362, 3370, 3372, 3374, 3386, 3390, 3393, 3408.

3349. W. Phelps. *Improvements in locks.* Dated December 15, 1862.

These improvements are as follows:—In the axis of the keyhole is a hollow spindle, carrying at either end a disc, the disc on one end of the said spindle being circular, and the other disc being of the figure of a circle, with a portion cut away through about a quadrant. The cut away portion is of a circular curve, but of less radius than the other portion. A shoulder or tooth is formed by each junction of the part of large diameter with the cut away part. The said discs are of somewhat greater radius than the acting part of the key, and have each a hole cut in it for the introduction of the key. The turning of the key effects the turning of the discs. In the lower part of the lock and between the discs a lever works. The said lever turns at one end on a centre, and its other end carries a projecting block which is made to bear on the periphery of the toothed disc by the action of a spring. The said block is toothed both on its upper and lower sides, its teeth engaging with those on the disc, and preventing more than a partial rotation of the discs so long as the lever remains in its normal position. The upper edge of the said lever on which the key acts is deeply indented at the part opposite the key hole, so that when the key is introduced into the lock, that part which is formed to act on the lever enters the said indentation. The said indentation in the upper edge of the lever has on either side the figure of a convex curve, so that the key cannot be turned in either direction without coming in contact with one of the curved parts of the lever. The motion of the lever upwards is limited by the before-mentioned projecting block bearing against the periphery of the toothed disc, and its motion downwards is limited by a stop. The action of the several parts is as follows:—When the key is introduced and turned in either direction, it acts on the curved part of the lever, and depresses the said lever sufficiently to permit the discs to rotate, the toothed projecting block on the lever being depressed out of the range of the teeth on the toothed disc. The key and discs having freedom of motion, the bolt of the lock is shot or withdrawn by the key in the usual manner. If a false key is introduced into the lock, it either depresses the lever too much or not enough. If it depresses the lever too much, the said lever is arrested by the stop, and the key cannot rotate; if it does not depress the lever enough, the teeth on the projecting block engage with the teeth on the toothed disc, and prevent the rotation of the discs and key. The action is the same whether the key is introduced from one or other side of the lock. When the key is left in the lock in any other position than that at which it may be drawn out, the keyhole on the other side is closed. *Patent completed.*

3350. M. Hyams. *Improvements in the manufacture of cigars, cheroots, and cigarettes, and in the treatment of tobacco.* Dated December 15, 1862.

In manufacturing cigars and cheroots, the inventor inserts in the bunch a piece of carbon or charcoal which acts as a filtering medium. *Patent abandoned.*

3351. E. B. Wilson. *Improvements in machinery or apparatus for rolling metals.* Dated December 15, 1862.

This invention relates to a peculiar construction and arrangement of conical rolling mill, and consists in driving one roll direct from the main shaft by suitable gearing, the other roll being driven direct from the first roll by intermediate gearing; or it may be found that the pressure applied to the rollers will be sufficient to drive the second roll, in which case the intermediate gearing may be dispensed with. One of the rolls is adjusted either by screw, cam, or hydraulic power. In the case of rolling hoops, tyres, and similar articles, in order to keep them perfectly circular, the inventor places one, two, or more guide rollers in the plan of motion. *Patent abandoned.*

3352. R. Kirk. *Improvements in machinery or apparatus for checking or stopping the motion of railway carriages.* Dated December 15, 1862.

Under one modification or system of arrangements, the axles of each carriage are formed with a small crank at the central part. These cranks are made, by preference, about half an inch to an inch in depth, and each crank is connected to the contiguous axle by a connecting rod which rises and falls with the rotary motion of the axles to an extent corresponding to the depth of the cranks. Above each connecting rod is fitted in the framing of the carriage or other suitable part a wheel, a portion of the periphery of which is removed so as to form a flattened surface. This flattened part of the wheel is, under ordinary circumstances, or when the apparatus is not in use, immediately over the connecting rod, and so that the rod in its reciprocatory motion just clears the under surface of the wheel. The spindle to which the wheel is fast extends outwards in a lateral direction sufficiently far to admit of the convenient attachment thereto of a small vertical lever. These small levers throughout the train of carriages are each connected by means of chains, or other suitable couplings, one to the other, the two end extremities being connected to hand levers which are respectively within convenient reach of the engine driver at the head of the train, and of the guard in the rear. With this arrangement of apparatus, when the train is proceeding safely, the chains hold the several wheels securely in position with the flattened parts above the connecting rods; but when it becomes necessary to stop the train quickly, the engineer or the guard slackens the chains by means of the hand lever, which admits of the wheels turning to a slight extent, and their peripheries act as so many wedges, and fix tightly the wheels of the several carriages, which are thus simultaneously held fast, and the train is very quickly brought to a standstill. *Patent abandoned.*

3353. J. McInnes and E. F. Prentiss. *Improvement in the distillation and treatment of petroleum and other like oils.* Dated December 16, 1862.

This invention has for its objects the distillation and treatment of petroleum and other like oils, by a continuous process, and in a film or shallow layer or layers, and consists in evaporating the oil upon a series of heated inclined planes of various temperatures, and which surfaces the patentees prefer to cover or partially cover with a layer of cast-iron filings, borings, or turnings, or any other suitable metal, or other good conductor or conductors of heat, to increase the heated surfaces into which the oil to be distilled is brought in contact. They also propose in some cases to use a thin layer or stratum of mineral or vegetable charcoal, lime, burnt clay, sand, or other deodorizing or partially deodorizing and purifying material, resting upon the heated inclined planes. Each of these heated inclined planes are enclosed in or form the bottom of an air-tight vapour chamber. *Patent completed.*

3354. J. Farley and J. Crowther. *Improvements in steam engines, and apparatus connected therewith.* Dated December 16, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

3355. G. C. Warden. *Improvements in ornamenting textile fabrics, leather, and other surfaces, in a cement employed therein, which is also applicable to the waterproofing of fabrics and materials, and in apparatus for applying and spreading such waterproofing cement.* (A communication.) Dated December 16, 1862.

This invention consists in ornamenting textile fabrics, leather, and other surfaces, by fixing thereon by means of the waterproof cement hereafter named, or by any other cement which becomes adhesive on the application thereto of heat, various designs, patterns, or devices cut out or stamped in silk velvet, leather, or other desired material. Another part of the invention consists in producing by means of lithographic or other engraving shaded effects upon the design to be fixed as aforesaid. Another part consists in the employment of silk or other fabric previously dyed of a colour to resemble that of the parts of the object forming the subject of the design to be fixed as aforesaid; for instance, if the design is to consist of a rose and leaf, the inventor takes pink or red silk for the rose, and shades the same by engraving, and green silk and shades it also to represent the leaf. The cement which forms part of the subject of this invention, is composed of the following materials in or about the following proportions; that is to say, seven parts of gutta percha, two parts of resin, and one part of solution of caoutchouc, mixed by dissolving them together under heat. The apparatus for applying and spreading the cement, whether in the designs or objects for ornamenting surfaces or for waterproofing, consists of a vessel or trough with overhanging sides, to which heat is applied to render the cement sufficiently fluid. The lower part of the vessel is formed or provided with a long narrow outlet closed by a roller free to revolve in adjustable bearings. The cement is rendered sufficiently fluid, and the material on which it is to be spread is drawn over the roller and in contact with it, when a coating will be evenly spread all over one face of the material. When the coated material is to be used for the ornamenting of any surface, it is placed thereon, and heat from an iron cylinder or otherwise is applied with pressure. When the cement is applied for waterproofing then a second material has to be employed, and which is caused by heat to adhere to the cement spread on the material as aforesaid, so that the cement may be enclosed between the two fabrics or materials. *Patent abandoned.*

3356. J. S. and S. Hancock. *Improvements in garotte knives.* Dated December 16, 1862.

This improved knife is made with two dagger blades at each end, both acted upon by one spring, which holds them when in the open position, the blades being released when it is required to close them by raising the end of the spring out of the notch in the blade. Or a catch may be used, acted on by the spring and released by pressing a small projection. The guards at each end of the handle, instead of being fixed to the scales, and projecting at right angles thereto, as is usually the case (and which makes the knife bulky and inconvenient to be carried), are fastened by pins to the blades close to the ends of the scales, and when the blades are closed, they close also, spontaneously turning upon the pins and lie along the blades parallel to the scales, and quite out of the way, but spring into their former cruciform position as soon as the blades are opened. *Patent abandoned.*

3357. O. Dickin. *An improved table fork.* Dated December 16, 1862.

Provisional protection has not been granted for this invention.

3358. J. J. Lemon. *Improvements in book trays or holders.* Dated December 16, 1862.

This invention relates to improvements in the construction of book trays or holders for the purpose of holding in position a series of books, and for their conveyance from place to place. These improvements consist—1, in constructing a series of levers, springs, and guide rods, by means of which the slide or slides and flaps of the tray can be opened for the purpose of inserting or removing books. For operating on double slides the levers are formed somewhat in the shape of a pair of scissors, and jointed in a similar way by a pin passing through the slide or edge of the tray, their handles extending outside the tray. Attached to the inner ends of these levers are rods working in slots at the under side of the tray, and moving the slides accordingly. In order to bring the slides back after the removal or replacement of a book, springs are attached from two corners of the tray to these levers. These springs may consist of spiral wire, flat curvilinear steel, or other known form of spring, suitable for the purpose; but for a single acting slide only one lever will be necessary with one spring attached. *Patent completed.*

3359. W. and A. Smedley. *Improvements in machinery or apparatus for the manufacture of textile or looped fabrics on warp lace machinery.* Dated December 16, 1862.

This invention relates to the employment of a stump guide or stump guides in addition to the guide or guides at present used in warp lace machines. The patentees employ one such stump guide to each of the guides in present use in ordinary warp machines (that is to say, the guides carried by one or more of the common guide bars in such machines), and they attach the stump guides to an additional bar or bars, that is to say, to a bar or bars employed in addition to the bars in present use; or they cast the stump guides in leads and screw the leads to a bar or bars which they attach to a common guide bar or bars in such manner that the two bars will move simultaneously, such movements being effected by a wheel or wheels, or by equivalent contrivances, or by a jacquard at either end of the machine. *Patent completed.*

3360. W. Hudson, H. Moore, C. Catlow, and S. Newbury. *Improvements in looms for weaving, and in arranging the warps therein.* Dated December 16, 1862.

This invention relates—1, To a method of diminishing the shock of the pickers. To accomplish this the inventors adapt a strap or similar apparatus to the front of the slay, which strap passes over two pulleys, and its ends are connected to buttons mounted upon the picker spindles. When one of these buttons is struck by a picker it draws the strap over the pulleys, and the other button is then ready to receive the blow of the other picker. Another part of this invention relates to a method of tightening the warp when the weft is to be driven up, and of loosening it when the shed is to be made. For these purposes they employ a roller above the warp beam, around which, as well as around the usual roller, a cord is passed. This additional roller is mounted so as to be caused to vibrate from the crank shaft or other moving part of the loom. Another improvement relates to a method of causing the slay to vibrate. For this purpose they dispense with the usual connecting rod, and cause the crank pin to move in a slot carried by the slay. In drawing in the warps the usual method for plain work is to take the first and third and the second and fourth, but according to this invention they take the first and second and the third and fourth. In working the healds, therefore, the first and third rise and fall together, and the second and fourth. *Patent abandoned.*

3361. J. L. W. Thudichum. *Improvements in collecting human excreta, and in the apparatus and means employed therein.* Dated December 16, 1862.

This invention relates to a mode or method of collecting the human fæces and the urine separately, the main object being the preservation of such excreta separate from each other. According to one mode of carrying out this invention, as applied to water-closets in connection with drains and sewers, it is proposed to so construct the pan of the closet, that the fæces shall fall into one compartment and the urine into another, the pan being divided by a transverse partition for that purpose. The compartment which receives the solid excreta is constructed similar to an ordinary water-closet, and opens into a drain-pipe leading to the sewer. The front compartment for the reception of the urine is connected by a pipe with a conduit or separate drain-pipe fitted into any convenient portion of the main sewer, so that the urine discharged into the closet will always remain separate from the other contents of the sewer. *Patent abandoned.*

3362. G. C. WALLICH. *Improvements in apparatus to be used in deep sea sounding for ascertaining the pressure and for raising specimens of the water.* Dated December 16, 1862.

This invention is carried out in the following manner:— For the purpose of ascertaining the pressure of the water, a strong cylinder or vessel is closed at one end by a fixed bottom, and at the other it has a moveable piston fitting water-tight within it. Inside the vessel the inventor places a mass of a solid compressible material, such for example as india rubber; this compressible material does not entirely fill the space within the vessel, but room is left around the solid for an incompressible or nearly incompressible liquid, such as mercury, and with this the remainder of the space is filled. When the vessel is lowered to a great depth into the sea, the heavy pressure of the water upon the outer surface of the piston causes it to move inwards, the compressible mass being made to occupy a smaller and smaller space as the pressure around it is increased. The liquid within the vessel ensures the pressure being applied to the solid mass equally in all directions. A record is kept of the distance the piston enters the vessel by placing on the rod or stem of the piston (which works between suitable guides) a projection, which, as the piston descends, moves a slider along a graduated scale conveniently placed on the side of one of the guides. When the instrument is drawn up after having been sunk, the position of the slider in respect to the graduations on the scale shows the pressure, and also the depth to which the instrument has been sunk. In order to bring up specimens of water from any required depth below the surface, the inventor suspends from the sounding line a horizontal cylinder open at each end; the cylinder is fitted with caps which, however, when the cylinder is lowered, are not in their places, but they are held in positions above the axis of the cylinder. They have india-rubber springs, which tend to draw them together; they are, however, unable to approach each other because the cylinder is between them, and keeps them apart. When the apparatus thus arranged has been sunk to the depth from which it is desired to raise a sample of water, a messenger weight is placed on the sounding line, and allowed to run down it; when it arrives at the apparatus, it strikes bars connected with the two caps, and pushes them down to the level of the cylinder, and when they are truly concentric therewith, the springs draw the caps together, and thus close accurately the ends of the cylinder. Suitable guides are employed to ensure that when the caps are pushed down they shall come truly into position to be drawn on to the ends of the cylinder by the springs. *Patent abandoned.*

3363. R. SCHOMBURG and A. BALDAMUS. *Improvements applicable to all kinds of oils used for illuminating purposes, whereby combustion thereof is rendered more perfect, smoke prevented, and the purity of the light increased.* Dated December 16, 1862.

This invention consists in leading the vapour from water to all kinds of oils while burning in lamps, whereby combustion is rendered more perfect and the purity of the light increased. The heat generated when the wick is lighted causes the vapour of water to ascend in a hollow cone or conical chamber round the wick-tube, and issue in contact with the flame about or above the point of its generation. A thin film rises from the water vessel up a narrow channel or space between two cones or conical caps with apertures through or between which the flame passes. The water vessel is by preference surrounded by another vessel or chamber between which a passage is formed through which air passes to the flame. *Patent completed.*

3364. H. JOHNS. *Improvements in clocks or timepieces.* Dated December 16, 1862.

This invention is designed for obviating the necessity for winding up clocks or timepieces periodically as at present practised. It is proposed to effect this through the agency of the variations in the temperature of the atmosphere, which are constantly taking place both inside and outside of dwellinghouses, and to employ the draught or current of air caused by such changes in temperature to set in motion certain mechanism to be connected to the ordinary mechanism of clocks, and by these means to produce a power sufficient to wind up a clock continuously, instead of having to wind it up by hand periodically, as at present practised. By this invention, a great part of the weight at present necessary to keep the going parts of a clock in motion may be dispensed with. *Patent completed.*

3365. R. HATTERSLY. *Improvements in apparatus for classing printers' types for composing machines.* Dated December 17, 1862.

This invention has reference to a previous patent, dated June 26, 1857, No. 1794. In performing the present invention, the patentee makes use of an inclined and curved table provided with channels or grooves, corresponding to the number of letters, figures, or other type to be classed. The entrance to these channels or grooves is widened to afford facility in placing the type therein, and at the entrance of some of the channels or grooves rows of shoots are applied to economize space. The type is deposited by hand into the entrances of the channels or shoots. Each channel or groove is furnished with springs or weights, to guide the type and prevent it from turning during its passage to the receiving sticks, which are made of angle brass, or other sheet metal. When the type has dropped into these receiving sticks, it is pushed forward by a cross bar acted upon by a crank, driven by a handle or otherwise. When these receiving sticks are charged, they are removed into a tray, ready to be taken to the composing machine. *Patent completed.*

3366. W. TONGUE. *Improvements in machinery and processes for preparing fibrous materials.* Dated December 17, 1862.

The first part of this invention consists in a particular method of working machinery for preparing fibrous materials, similar to that described in the specification of a patent granted to Henry Rawson, January 27, 1857, No. 249; and also in a particular method of working machinery for preparing fibrous materials similar to that described in a patent granted to the present patentee, dated March 5, 1862, No. 596. In this machinery a working comb is caused to rise and fall, and also to have a to-and-fro motion. Now, the present improvement consists in causing the working comb to have motion only in one direction, and to give the requisite motion in the other direction to the feed apparatus; that is so say, if the up-and-down movement is imparted to the feed apparatus, the to-and-fro movement will be imparted to the working comb; and if the to-and-fro movement is imparted to the feed apparatus, the up-and-down movement is imparted to the working comb. The second part of the invention relates to preparing machinery, in which rollers or other feeding instruments present fibrous material to the action of sheets of pins, screw gills, or other pointed surfaces continually moving or travelling through the fibrous material in one direction, and the improvements in this class of machinery consist in giving a reciprocating to-and-fro motion either to the feed apparatus or to the travelling toothed surface. The third part of the invention consists in an improved method of feeding stricks of fibrous material into machinery for preparing fibrous materials, such as is described in the specification of a patent granted to Henry Rawson, before referred to; also in an improved method of feeding stricks of fibrous material to machinery, such as is described in the specification of the patent granted to the present patentee, and before referred to; also in an improved method of feeding "stricks" of fibrous material to machinery, such as is described in the first and second parts of this specification. *Patent completed.*

3367. A. ALBINI. *Improvements in breech-loading fire-arms.* Dated December 17, 1862.

This invention consists of the improvements hereinafter described in opening the breech end of breech-loading firearms for the introduction of the charge, and in securely closing the same during the discharge. The patentee prolongs the breech end of the barrel beyond the discharge chamber to a length somewhat greater than that of an ordinary cartridge. The upper side of the prolonged part is open for a sufficient length to admit of the introduction of a cartridge. Upon the prolonged part there is a cap connected with a screw plug, which plug screws in the said prolonged part and closes it. A rod passes through a hole in the centre of the said screw plug, and terminates in the prolonged end of the barrel with a conical plug or closer, which plug or closer accurately fits the conical end of the charge chamber. The rod of the plug or closer is made semi-cylindrical, or of a prismatic figure, through the greater part of its length, its outer end being cylindrical and of small diameter. The hole in the screw plug, through which the rod of the closer works, is of the same figure as that part of the rod which passes through it. The projecting end of the rod is provided with a button or knob, by which the said rod can be pushed forward and withdrawn. When the rod is pushed home, and the plug or closer made to close the end of the barrel, the screw plug is turned by means of a handle attached to it, and the hole in the said screw plug is made to cross the end of the rod, and a shoulder on the said rod is thereby supported by the said screw plug, and the plug or closer firmly fixed to its seat. The firearm is then ready for discharge. To recharge the firearm after firing, the screw plug is turned a semi-rotation, so as to bring the opening in the said screw plug coincident with the rod of the closer. The said closer can now be withdrawn from the breech chamber and a fresh cartridge introduced. *Patent completed.*

3368. C. DEFRIES. *Improvements in the manufacture or construction of lamps.* Dated December 17, 1862.

A lamp made according to this invention has no body framing, or, in other words, offers no impediment to the rays of light. It may (as for galleries, piazzas, and other places where it is desirable to throw the light upwards) have a shadowless top or cover, similar to the body of the lamp. Or the cover may be made of tin, iron, or other material, and be of any shape or form, and be painted or enamelled in its interior. The patentee supports the lamp body principally by means of the gas pipe, whether the lamp be a street lamp or a bracket lamp (the means of support therefore being also the means of lighting). This pipe runs through the bottom glass of the lamp body upwards, till it breaks into horizontal radii or arms, which pass into a horizontal framing forming the top of the body of the lamp, so that (except in street lamps where the scroll above the capital assists) the whole lamp is supported by the centre or gas pipe. A further improvement in the street lamp is to place the carburator (with which it has of late become the practice to furnish each lamp) immediately under the body of the lamp, and just above the capital of the pillar or post; thus it is partially hidden from the passengers, and but little obstructs the downward rays of light. *Patent completed.*

3369. T. KNOWLES. *Certain improvements in machinery or apparatus to be employed in preparing and spinning cotton and other fibrous substances.* Dated December 17, 1862.

This invention relates to the machinery employed for preparing and spinning cotton and other fibrous substances, called roving and slubbing frames, throttles, and similar or equivalent machines, and is designed to effect the stoppage of the machine or a portion thereof by self-acting means in the event of a thread breaking. The invention consists in an arrangement of apparatus in which a rotating disc causes a reciprocating traverse of a sewing piece, one end of which is in connection with the stop rod of the machine, the other being attached to a bent finger, which is thus continually moved in and out of an aperture in the framing of the machine. Above these apertures a light lever is hinged in the said framing, and kept from falling over the aperture by the yarn or thread, which is made to support it, and, whilst in such position the machine can continue to work; but, if the thread become disunited, the lever falls, and prevents the bent finger from entering the aperture, and thus in stopping the sliding piece disconnects the driving power, and stops the faulty part of the machine. One such apparatus is applied to each thread or yarn. *Patent abandoned.*

3370. J. R. HAMPSON. *Certain improvements in the method of securing the extremities of the hoops or bands employed in packing bales, and in apparatus connected therewith.* Dated December 17, 1862.

This invention consists in the novel employment and use of studs or connections having two heads, one of which heads is cut away on each side of the centre to form a T-head. The apertures in each end of the hoop are formed like a straight slot, so that the studs are passed through the ends of the bands, the narrow way, and then turned half round, which prevents them passing back again, and which secures the ends of the band or hoop together. A second part of the invention relates to the punching of the holes in the loops, and it consists in the application of a crank or an eccentric to the ordinary form of punching apparatus, instead of the long levers at present employed. *Patent abandoned.*

3371. J. THORNE. *Improvements in apparatus for regulating the flow of gas to burners.* Dated December 17, 1862.

This invention consists of a valve fixed in a metal chamber, the lower part of which is attached to the supply pipe, and the upper part supplied with a gas burner. The valve is formed of a hollow tube having a set-off at its base, which is of enlarged diameter and capacity; inside this tube is another tube of smaller diameter, having an inverted cup attached to its outer surface at its upper end, so as to fall over the external surface of the larger tube, and rest on projections on the set-off or upper part of its base. This inner tube has a notched ring attached to the outer part of its cup, and is longer than the smallest part of the outer tube. An inverted cup of larger diameter than that which is attached to the second or inner tube is placed over this second tube, resting on the notched ring, and to this large inverted cup is attached a cup or disc of metal, or other suitable material, a little below the lower end of the second or inner tube. The valve in this position has its passage between the parts open through which the gas passes freely to the burner when the pressure is low; but if the pressure of the gas is more than equivalent to the weight of the large cup, they are raised, and the cup or disc is pushed up against the lower end of the inner tube, thereby shutting off that communication to the burner, and on the pressure further increasing the inner tube is raised, the cup or disc coming in contact with the under part of the set-off of the outer tube or seating of valve, the aperture through which the gas has to pass being decreased in size as the pressure increases, and on the pressure of the gas becoming less the parts which had been raised fall, and the apertures again open. *Patent abandoned.*

3372. J. RAMSBOTTOM and G. HACKING. *Improvements in machinery or apparatus for measuring and registering the flow of water and other fluids.* Dated December 17, 1862.

This invention relates to fluid meters, and consists in improved arrangements or contrivances for increasing the simplicity of structure, the accuracy of registration, and the general efficiency of those important instruments. The patentees dispense with the racked piston rod in those meters distinguished as the tumbler class, and thereby effect greater compactness and reduction to a direct, simple, and well supported form what has hitherto been a bulky and more complicated one. The invention cannot be described without reference to the drawings. *Patent completed.*

3373. J. W. HADWEN. *Improvements in machinery or apparatus for spinning, twisting, and doubling cotton and other fibrous materials.* Dated December 17, 1862.

This invention relates to mules and twiners, and consists in building the cop or bobbin upon a tube revolving upon a stationary spindle, the loose tube being put in motion in any desired manner. The stationary spindle is fixed on the top spindle rail, and the tube is made to revolve by a band from the ordinary pin, roller, or drum. The great advantage of this system consists in being able to run the loose tube at much greater speed and with less friction than the ordinary spindle, as much as 8,000 to 10,000 revolutions per minute, whereas the ordinary spindle only runs at from 5,000 to 6,000. *Patent completed.*

3374. T. C. BARRACLOUGH. *Improvements in machinery for spinning, twisting, and rolling tobacco.* (A communication.) Dated December 17, 1862.

This invention consists in an apparatus, hereinafter described, for spinning, twisting, and rolling tobacco at one operation. The patentee takes one or more rectangular or other shaped revolving frames or flyers, each provided with two pivots, one of which forms a hollow trunnion for the tobacco to pass through as it comes from the feeder, and the other carries a pair of driving pulleys, or other suitable mechanical means, for imparting rotary motion to the frame. Transversely to the revolving axis of the frame, and within it, is fixed a spindle which carries a bobbin on which the spun tobacco is rolled up. The bobbin is removed from the spindle in order to strip the roll of tobacco from it; and, for this purpose, one of the flanges is removed, which, when the bobbin is at work, is secured by screws or otherwise to its spindle. The equal distribution of the tobacco on the bobbin is effected by a guide travelling backwards and forwards parallel to the bobbin. *Patent completed.*

3375. F. DE WYLDE. *The protection and preservation of lead surfaces exposed to the action of water, and for the protection of such surfaces from decomposition by atmospheric action.* (A communication.) Dated December 17, 1862.

This invention consists in rendering lead surfaces insoluble in water by transforming the metallic lead into a sulphuret of that metal, thus preserving from corrosion pipes and cisterns exposed to the action of water, and roofs and other surfaces exposed to the alternate action of water and atmospheric air, and also preserving water in contact with such surfaces from contamination. *Patent abandoned.*

3376. L. Latter. *Improvements in ploughs.* Dated December 17, 1862.

This invention relates to an adaptation or combination of parts particularly adapted to ploughing up-and-down land without the necessity for turning the plough at the completion of each furrow. The operating parts of the plough—as the coulter, share, and mould plate—are formed in duplicate, and pointing in opposite directions. The portion of that part of each mould plate which, in ploughs, as generally arranged, is the hindermost, and effects the turning over of the soil, is removed, and in lieu thereof the patentee employs a bar or plate capable of turning near one of its ends on an axis of motion, and of being held in the required position to serve as a continuation of either mould plate to effect the complete turning over of the furrow slice. This bar or plate, at its outer end, carries cutters or seam pressers to cut or pare off a portion of the furrow slice, and allow it to fall into the furrow to receive the seed. The mould plates, from their junction with their shares, rise quickly from near a horizontal to a vertical line, or nearly so, by which advantage is gained, particularly in operating upon heavy land, in completely turning over the slice. The sole plate and other of each set of the operating parts of the plough incline upwards slightly from the centre of the sole plate, by which steadiness in working is obtained. The plough beam is similar at both ends, and has two pairs of supporting or carrying wheels, arranged so that when one pair is in operation the other pair may be out of operation. One of each pair of wheels is intended to run in a furrow, the other on the land. The draught is from the centre of the length of the combined plough by means of a lever or bar, which is capable of turning on such centre for the action of either set of working parts, and of being set as desired. One end of this lever or bar is formed with handles for the use of the ploughman, and the other for the attachment of the horses. *Patent completed.*

3377. R. Wheeler. *Improvements in ploughs.* Dated December 17, 1862.

According to this invention, in place of a single coulter, the inventor employs two or more coulters, producing as many separate slices, then the share follows, and the mould board turns over all the slices at once; thus the land becomes more thoroughly divided, and the air is better able to penetrate it. He also, according to this invention, attaches to a plough having a coulter or coulters, share and mould board, or mole or subsoil line, for stirring the land below the sole of the plough, at the same time that ordinary surface ploughing is effected. *Patent abandoned.*

3378. H. Burton. *Improvements in castors for furniture and other purposes.* Dated December 17, 1862.

In carrying out this invention the inventor proposes, instead of employing a wheel rotating on an axis set in a curved and moveable arm at the bottom of the socket of the castor, to substitute a globe or ball of brass, or other suitable metal or material, nearly one half of which protrudes through a circular aperture at the bottom and centre of the socket. Within the socket a circular plate or disc is to be placed, underneath which three or other number of projections in pairs are to be screwed or fixed, forming bearings for the reception of three or other number of similar but smaller metal or other balls, furnished with trunnions entering the bearings in the projections, these balls forming bearing surfaces for the larger ball. The disc is fixed in the interior of the socket by means of screws, and above the disc; the foot of the piece of furniture or other object is fixed by screws and glue or other adhesive solution. *Patent abandoned.*

3379. G. A. Huddart. *Improvements in buttons.* Dated December 17, 1862.

This invention is not described apart from the drawing. *Patent completed.*

3380. W. Clark. *Improvements in holders for lamps, candles, and other lights.* (A communication.) Dated December 17, 1862.

This invention relates to a means of supporting candles or lamps, or other similar lights, in such manner that the candle, lamp, or other light shall retain its vertical or normal position at all times, or nearly so, although the holder in which the lamp, candle, or other light is held is itself inclined in any direction. For this purpose the inventor applies a sphere to the candlestick or lamp holder, which sphere rests and supports the lamp or candlestick in a ring, or it may be an opening, in the upper and small end of a cone, such ring or opening being of a diameter less than the sphere; from the sphere depends a weighted rod or pendulum, the tendency of which to being always in a vertical position maintains the lamp or candle at all times in its proper position, although the cone stand or other holder may be oscillated or inclined to a considerable extent. *Patent abandoned.*

3381. C. J. L. Leffler. *Improvements in constructing armour for ships and fortifications.* Dated December 17, 1862.

For the purposes of this invention, the inventor employs bars of a width sufficient to form the thickness of the armour, and he places them the one on the other, so that the edges of the bars form the face of the armour. So far the arrangement is similar to what has before been proposed; but the inventor does not as is now usual form rivet or bolt holes through the bars, as such holes greatly weaken the bars, nor does he otherwise connect the several bars the one to the other throughout the whole length, so as to prevent their yielding when struck independently the one of the other, for a rigid mass is more easily penetrated by a shot than one that is able to yield to the blow; but he secures the bars at their ends by causing them to enter grooves in metal ribs or frames, which are attached to the main frame of the ship or structure. These ribs or frames are formed of metal bars rolled in one piece to the required grooved form. He does not attach the grooved ribs or frames to the main frame by through bolts, as this would weaken the frames, but he forms recesses in the grooved ribs or frames to receive the heads of bolts, and these bolts, where a timber backing is employed, pass through this backing to the frame behind. He makes each bar a compound bar—a bar of steel and a bar of iron welded together. The top bar of the series he forms much stiffer and thicker than the others, so that it may be able to keep the other bars in their places—thus the top bar becomes, in fact, a narrow armour plate, and it may be secured by through bolts in addition to the grooved ribs or frames before mentioned. In constructing armour plates he forms a pile of alternate plates of iron and steel laid one on the other until a sufficient thickness is obtained, and he welds these altogether, and such armour plates may be secured in their places by means of grooved ribs or frames retaining their ends. *Patent abandoned.*

3382. E. Precht and V. Toepken. *Making and packing friction matches.* Dated December 18, 1862.

Provisional protection has not been granted for this invention.

3384. J. Clayton. *Improvements in reverberatory furnaces for heating large masses of iron and steel, and in economizing the waste heat of the said furnaces.* Dated December 18, 1862.

In carrying out this invention, the patentee makes the middle of the furnace moveable, the said middle of the bottom of the furnace being supported on a carriage having four or other number of wheels. By this arrangement the bottom of the furnace can be wheeled away or drawn from under the reverberatory arch of the furnace, and the mass of iron or steel to be heated placed thereon. The moveable bottom may then be restored to its place under the reverberatory arch, and the mass of iron or steel heated. The heated mass may be removed on the moveable bottom to the rolls or other machinery by which it is to be rolled, hammered, welded, or otherwise operated upon. The carriage conveying the moveable bottom may be loaded with the pile or mass of iron or steel on the side of the furnace opposite to that at which the heated mass is operated upon; that is, the carriage being wheeled from under the reverberating arch, and the heated mass delivered on one side of the furnace, the said carriage is wheeled back under the furnace and out on the other side where the pile or mass to be heated is hoisted and lowered on the carriage. The cinder or slag produced during the heating of the iron or steel falls on the bottom of the furnace, which said bottom is made concave and inclined downwards from the middle towards either end. The melted slag or cinder is thus conducted to the ends of the bed of the furnace, whence it falls into two under waggons, one placed under the carriage at each end to receive it. The under waggons work under the carriage carrying the moveable furnace bottom. The carriage and waggons work on inclined tramways. The sides and bottom of the furnace are closed by doors. The doors closing the upper part of the sides of the reverberating arch open by a vertical sliding motion, and are supported on balanced levers. The doors closing the space underneath the bed of the furnace work upon hinges, and are provided with ventilators by which air can be admitted to the pile to regulate the temperature. The sliding doors have small sight doors working on hinges. The carriage is moved by means of a chain, which may be worked by a steam engine, or other means. Double grated furnaces are employed, the bottoms of which are concave undermost, and convex at top. Each grate has a door working on hinges with a small ventilator in its middle to regulate the quantity of air entering the fire. The improvements in economizing the waste heat of the said furnaces consist in causing the said waste heat to heat one, two, or more longitudinal or vertical steam boilers, situated over or at the end of the furnace. The said boilers are supported on columns, and are provided with tubular flues through which the heated air from the furnace passes and heats the said boilers, and thence passes to the stacks or chimneys. *Patent completed.*

3385. E. Habel and E. Luckow. *Certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous substances.* Dated December 18, 1862.

This invention consists in a novel and peculiar arrangement and construction of apparatus, which is equally applicable to spinning yarn, either in the form of cops or bobbins, and may be described as follows:—The spindle upon which the cop or bobbin is formed has a bearing in a footstep in a copping rail, and is supported at a higher point by a long bush terminating in a cylindrical case which encircles the spindle, and is sufficiently wide to admit the formation of a cop or bobbin within it, and is driven by a band passing round a pulley thereon. From the upper edge of this case a wire extends in the form of an arc or cone, and is provided with a peculiarly formed "oilet" at the apex, and others at convenient distances on the wire, by which means the yarn passes, and is spun directly from the drawing rollers to the cop or bobbin. The copping motion may be obtained by cams, as in the ordinary manner, or by means of a rotating disc having two studs acting upon a bell crank lever. In spinning cops, a long tube is employed on the spindle, which may either be furnished with a bottom plate and flannel washers to create the required drag, or it may be suspended upon the point of the spindle, and a spring employed acting on the surface of the cop to effect the pressure or drag, or a fan may be placed on the spindle for the same purpose. *Patent abandoned.*

3386. G. Russell. *Improvements in cranes.* Dated December 18, 1862.

This invention has for its object to construct a crane which, whilst it is of comparatively light and simple construction, shall be capable of covering a large area, or, in other words, of transferring a heavy load from any one point to another of a large area. In carrying out the invention, according to one modification, a jib, such as is commonly used in cranes, is combined with a short pillar or standard frame, which is either vertical or somewhat inclined, and from the top of which there proceed the usual adjusting chains or tension rods to the the upper or outer end of the jib. From the upper part of the pillar or standard frame there also proceed one or more tension rods, which is or are jointed to a pin or stud firmly secured in the ground or foundation. The lower part of the pillar or standard frame is connected to the fixed pin or c... triangular or other frame or frame piece serving ... The pillar or standard frame is mounted on a w... porting frame or carriage, or is arranged to slide ... or rails, or on a suitable surface in a circle round ... pin or stud, which thus forms a centre about ... crane may be moved. By connecting the pillar or ... frame in the manner described with a fixed poin... balance is dispensed with, and the jib can be made ... round a circle of much larger area than in other ... rangements, seeing that such area is what can be ... only by the radius of the jib merely, as measur... tally, but by that radius added to the distance of ... or standard frame from the fixed central pin or ... giving suitable inclinations and proportions to the ... to the standard frame or mast, or other subst... fore, the strain may be made to act in a vertical, ... vertical, direction upon the supporting frame ... in which case the horizontal strut between the ... carriage and the central fixture may be dispensed ... made of slight proportions. *Patent abandoned.*

3387. W. V. Wilson and F. A. Manning. *Pr... tion of colouring matters.* Dated December 18, 18...

Provisional protection has not been allowed for ... vention.

3388. J. and A. Brierley. *Improvements in ... engines.* Dated December 18, 1862.

This invention relates to that class of carding ... known as single doffer condensers, and the impro... consist—1, in placing a strip or ring of metal ... suitable material, in each space betwixt the ... on the doffer cylinder, so as to completely fill ... to near the points of the teeth, and thus form ... of the cards, by which means wool or other f... carded may be effectually divided and doffed ... strips. 2, The improvements consist in the employ... an additional roller for supporting the rubbing ... an additional rubbing roller by which a better ... produced than heretofore. *Patent completed.*

3389. J. Pernod. *A production derived from ... called "purpurine."* Dated December 18, 1862.

The madder, in carrying out this invention, is ... in water so as to form a fluid paste; it is then ... water, and sulphuric or chlorydric acid added, and ... is put to ebullition. After the mixture of mad... and acid has been maintained at the temperature ... 100 deg. centigrade (equal to about 212 deg. Fahr.) during two or three hours, it is put into a filter ... a complete washing, which operation is finished ... water presents a reddish colour somewhat like ... strained matter is then dissolved in a sufficient qu... water to form a fluid paste; it is then placed in a ... vessel, and exposed to a temperature never to ... deg. centigrade. After maintaining the ebullition ... two to five hours, according to the nature of the ... employed, it is then left to cool, filtered and stra... pletely, and the produce is then dried and red... powder, and in that state delivered to the trade. ... *abandoned.*

3390. G. Savory. *An apparatus for the inha... medicinal powders or vapours for the treatment of ... the throat and lungs.* (A communication.) Dated ... ber 18, 1862.

This apparatus consists of a receptacle of glass ... any other suitable material, into which are introdu... palpable powers, also certain liquids, such as ... creosote, &c. The powder or the vapour of liquids ... out of the receptacle by means of an india-rubber ... containing air connected by an elastic tube. On the ... site side of the receptacle is fitted a tube of ivory ... perforated at its extremity with small apertures to ... the powder or vapour into the throat or chest. ... *completed.*

3391. G. Longland. *Improvements in street ...* Dated December 18, 1862.

In carrying out this invention, the patentee pla... verted reflectors on the roofs or covers of such lamps ... level with the roofs or covers, or in any way above the ... which reflectors can be made of looking glass, silvered ... enamelled or ware plates, polished metal, or other re... substance; they may also be set at any required an... their number may be varied; the lamp may also be ... form of a triangle or square or circular or other figure ... he prefers the square, making the lamp very broad ... eaves, and diminishing the size to very small propor... the bottom, so that there is no bottom glass requir... glasses are the total number, exclusive of the re... which are protected outside with tin, zinc, copper, or ... protective covering. *Patent completed.*

3392. S. C. Lister. *Improvements in preparing, ... and spinning flax, silk, &c.* Dated December 18, 18...

The first of these improvements consists in pre... flax, rhea, and other vegetable fibres before comb... same upon drums or straps covered with fine teeth, ... less than 15 per square inch, but the patentee prefers ... the first operation, 100 for the second, and 200 for the ... time of passing it through the drums. Another par... invention—which is more particularly adapted for ... pierced cocoons, but which also answers well for pre... silk waste—is to make 2 straps of teeth to work ... gether; the cocoons or waste may be fed to them in ... suitable manner. The upper sheet should travel ... opposite direction to the lower. Another impro... consists in using drums for preparing silk waste (other ... cocoons) having more than 6 teeth to the square inch ... he prefers about 20 for preparing it the first time, ... to 100 for the second time over. Another impro... consists in using drums with teeth set much ... have been hitherto used for preparing silk waste ... patentee has discovered that pins standing out of the ... or other surface about half an inch, when very fine ... are used about quarter of an inch, will stand very ... with care will last a long time. Another of the im... ments in combing consists in making filling ... machines such as were patented by the present patentee

7th August, 1855, No. 1785, circled to the form of the :hine, and also having them constructed with gill or er teeth; or if the machine be straight, the filling heads r be made the same, but he prefers a circular machine. other improvement in such machines consists in in- sing the number of rows of teeth, as he finds that when ›ws only are used—as shown in the original patent—that fibrous material is apt to ruck at the back of teeth and ke more waste, and a worse sliver, than is the case when number of rows are increased. This can be readily done placing teeth in the front nipper, and increasing the nber of rows at the back of the back nipper. Another provement consists in making the filling heads of such chines as those patented by Lister and Warburton in 9, No. 2832 (under the first head of the said invention the said patent), to approach the comb, instead of having m stationary, as therein shown. The instrument which present patentee finds answer best is a filling head structed on Rawson's plan. The improvements in spin- g consists in giving a rubbing action to the rollers of a nning frame. The upper roller moves in one direction, ilst the lower moves on the contrary. The shafts upon ich the rollers are fixed have cranks attached to the end them, so as to give the required motion. *Patent completed.*

3393. A. V. Newton. *Improved apparatus for trans- tting power.* (A communication.) Dated December 18, 32.

This invention relates mainly to a novel arrangement or mbination of gearing applicable to the transmission of wer to steering, twisting, or hauling apparatus. The in- ntion may be described as consisting in the arrangement 2 cog wheels with a different or equal number of teeth, ie being firmly secured to the drum of a steering, twisting, hauling apparatus, and the other being stationary; or hen the apparatus is to be used for hoisting or other pur- ›ses, the former wheel being stationary, and the latter cured to the drum or drum shaft. In combination with iese cog wheels are pinions having an equal or different umber of teeth, and attached to a tumbling shaft which carried round the drum-shaft in such a manner that, on otating the wheel or drum shaft by the combined action f the two pinions on the tumbling shaft and the differen- ial wheels, a slow rotary motion is imparted to the drum or to the drum shaft when used for hoisting or other pur- oses). The power applied to the wheel shaft or to the umbling shaft is multiplied in proportion to the number f teeth of the gear wheel, which is fast to the drum, divided by the difference between the number of teeth of he said wheel and that of the stationary wheel, or, if the number of teeth of these cog wheels is equal, divided by he difference between the number of teeth of the two inions on the tumbling shaft, it being understood that a difference must exist either between the number of teeth of the cog wheels or of the pinions, or both. *Patent completed.*

3394. J. Holden. *Improvements in means or apparatus employed in preparing and combing wool and other fibres.* Dated December 18, 1962.

We cannot here devote space to the details of this in- vention. *Patent completed.*

3395. J. Holden. *Improvements in means or apparatus for washing wool and other fibres.* Dated December 18, 1862.

This invention relates to, when employing prongs, grates, or other surfaces adapted to conduct wool and other fibres through a trough of wash liquid for the washing thereof, effecting at the same time an intermittent for- ward and partial retrograde action to such means. For this purpose the prongs, grates, or other instruments may be applied to plates, bars, or carriers, which are controlled to move in irregular courses, or in courses with alternate progressive and retograde action, by which such instru- ments during their progressive motion will effect a forward and partial backward action to their points or operating ends upon the fibre. *Patent completed.*

3396. J. L. W. Thudichum. *Improvements in the pre- servation of beer and other fermented liquids, and in the apparatus and means to be employed therein.* Dated Decem- ber 18, 1862.

According to this invention, it is proposed to supply the cask or other vessel containing the liquid to be preserved with carbonic acid gas derived from any convenient source, such supply of gas being turned on at intervals, or each time a portion of the liquid is drawn off, the atmosphere at all times being excluded from the cask or vessel. *Patent abandoned.*

3397. W. S. Longridge. *Improvements in machinery for rolling tyres, hoops, and rings.* Dated December 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3398. E. B. Wilson. *Improvements in machinery or apparatus for forging and pressing metals and other sub- stances.* Dated December 19, 1862.

This invention consists in the use of a powerful lever actuated by a screw cam, steam, or hydraulic pressure, so as to produce either a constant or intermittent pressure upon the metal or other substances to be operated on, such substances being forged or pressed into any desired form by the aid of suitable dies situate under the lever before men- tioned. *Patent completed.*

3399. D. Davidson. *Improvements in the construction of telescopes, and in the method of arranging and fixing the same in combination with firearms for the purpose of adjust- ing the aim thereof.* Dated December 19, 1862.

This invention consists of certain improvements in the construction of telescopes, and in the arrangement thereof in combination with firearms, and supplies the require- ments in the method of taking aim consequent upon the improvements which have recently been made in the con- struction of the rifle and the great extension of its range. One part of the said invention consists of the following improvements in the construction of telescopes to be used in combination with firearms as before mentioned:—The field bar of the telescope is finished with two slides moving at right angles to each other, and worked by screws, each side carrying a cross hair or line, one of such lines thus being horizontal while the other is vertical. The hori- zontal line is for minute adjustment of the telescope in elevation, the vertical line being for allowance for side wind. The intersection of the lines when adjusted gives the aim. This improvement is applicable to the telescope, whether the latter be fixed to the rifle or other piece in the manner hereinafter described, or in any other manner. The other part of the said invention consists of improve- ments in arranging and fixing telescopes, of whatever kind, in combination with firearms, and is especially applicable to rifles and other small arms. The telescope is applied at the side of the piece, so that when depressed for the long range it clears the muzzle of the barrel. The body of the telescope is enclosed in a metallic tube, on which are fixed two collars, one at the object end of the telescope, and the other about 5 in. from the eye end thereof. The collar next the eye end is constructed with a neck furnished with square projections or lugs, the said neck entering a cor- responding hole in the escutcheon plate of one of the lock screws, the lugs taking hold of the inside of the plate on the collar being twisted. A joint is thus formed in which a sufficient amount of elevation or depression can be given to the telescope. The collar at the object end of the telescope is furnished with a quadrant, which latter presses against a plate of metal inserted into the stock of the piece at about 10 in., or at some other convenient distance, from the breech. A screw, furnished with a milled head, passes through the stock under the barrel, and through the before- mentioned plate of metal, and by means of a milled nut on the end of this screw (the head of which screw takes hold of the edge of the quadrant) the quadrant can be clamped securely at any required angle. *Patent completed.*

3400. A. V. Newton. *Improved machinery for attaching metal eyelets to cloth and other materials.* (A communica- tion.) Dated December 19, 1862.

This invention has for its object to facilitate the inser- tion of eyelets into fabrics and garments, and consists in the construction of a machine having a stationary punch or die, and below it a reciprocating bolster or die arranged in line with each other, together with a box for containing the eyelets, attached to which is an inclined shute down which the eyelets pass from the box to a position between the fixed and moveable dies. A reciprocating brush, mounted excentrically in the box, assists in the delivery of the eyelets into the shute, the openings through which the delivery takes place being of such form as to ensure the eyelets being delivered right side up. *Patent completed.*

3401. J. Dalton. *Improvements in knitting machinery.* Dated December 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3402. J. B. Morrison. *Improvements in washing machines.* (A communication.) Dated December 20, 1862.

This invention consists in the novel construction and arrangement of the parts of a washing machine, whose mode of operation closely resembles the hand process. This peculiar effect is produced by the employment of a corrugated or plain wash-board in connection with a yielding roller or rollers, or corrugated boards. The parts are so formed and combined as to secure cheapness of con- struction and convenience in operating the machine. *Patent completed.*

3403. F. W. Harvey. *Improvements in fitting and connecting rudders to ships and other floating vessels.* Dated December 20, 1862.

This invention is carried out as follows:—Along the edge of the stern-post of a ship the inventor forms a cir- cular shaped groove or channel, with a slit or opening along the same, and the bottom thereof he forms solid and circular; the said groove or channel is intended to receive the shaft of the rudder, which should be formed cylindrical and fit easily therein. He also forms an open- ing through the deck of the ship sufficiently large to re- ceive the rudder, which has simply to be lowered from the deck through the said opening, the shaft of the rudder being securely guided by and held in the grooved channel aforesaid; by these means the use of "pintels" and "gudgeons" at present used for connecting rudders to ships are entirely dispensed with. To the top of the rudder-post he connects a swivel cap, and the well-known right and left handed screw steering tackle; to that end of the screw of said tackle situate furthest aft, he connects a long pin vertically, the said pin passing through a hole in a standard fixed to the ship's deck, so that upon the rudder striking upon any substance, the rudder will be lifted, and with it the steering tackle and wheel, the long pin serving as the fulcrum for the tackle to move upon. Upon the obstruction being removed, the rudder and tackle will descend to their normal position by their own weight. He proposes to adapt tiller ropes to the shaft of the rudder in case of accident to the screw steering tackle, and to connect the same to an arm fixed on the rudder, the shaft serving also to indicate the true position of the feather of the rudder during the steering of the vessel. These improvements are especially adapted for iron ships. *Patent abandoned.*

3404. A. T. Blakely. *Improvements in breech-loading ordnance.* Dated December 20, 1862.

The object of the first part of these improvements is that the opening of the breech or separation of the breech-piece from the barrel may be effected by the act of firing, so that the firing of one charge will, in addition to throwing the projectile, open the parts and leave them in the position to receive a fresh charge. For this purpose the breech-piece projects into the barrel, and is retained in position by weight or elastic pressure proportionate to the power exerted by the pressure of the charge in firing. The firing causes the propulsion of the projectile, and at the same time the recoil of the breech-piece, thus opening the parts for the supply of a fresh charge. The breech-piece enters the barrel to an extent sufficient to ensure its not leaving the breech end thereof until the shot or shell passes out of the muzzle. Holding means retain the parts when opened. 2. The improvements relate to mounting ordnance to be fired through port-holes or embrasures, so that the axis of vertical motion is at or near the muzzle thereof, and at the port-holes or embrasures. As in this case the weight of the gun and its carriage will not, as is ordinarily the case, be balanced near the axis of rotation, and, consequently, great power will be required to move them, the patentee prefers to apply the power required by means of hydrostatic pres- sure exerted from a reservoir placed at a sufficient eleva- tion, or by hydraulic apparatus. *Patent completed.*

3405. J. Nettleton. *Improvements in stoves.* Dated December 20, 1862.

For the purposes of this invention, it is preferred that the external form of a stove should be cylindrical, though this is not essential. The interior of the stove, which is of iron, is lined with a hollow cylinder of fire-clay. Longi- tudinal air passages are formed up through the sides of such lining; or these air passages may be produced by having two linings of fire-clay with sufficient hollow spaces or passages between them to allow of fresh air passing through such passages from the bottom to the top of the stove without coming in contact with heated metal. In this part of the stove is an opening to receive fire-bars. The lower part of the stove, below the bottom grating of the fireplace, is enclosed, by which means a chamber is formed around and below the ashpit. The chamber at the bottom of the stove is arranged to communicate with the outer atmosphere by a suitable pipe or flue, by which pure air is introduced into the bottom chamber, which communicates with the air passages in the fire-clay lining by which the air thus introduced derives heat from the heating passages in the fire-clay linings. The heated air rises into an upper chamber of the stove above the fire-clay lining, and passes through numerous openings into the room; a sliding drawer is introduced into the ash-pit below the bottom grating of the fire-place. The upper end of the lining of fire-clay is covered with a fire-tile, and from it descends a fire-clay or metal partition which descends below the opening near the upper part of the stove where the products of combustion are conducted off by a suitable flue to the chimney. The air for supporting the combustion is supplied from the room in which the stove is placed, and such air is allowed to pass into the fire through the front fire-bars, also over the fire, and also by passing through suitable air-passages in front of the stove into the ashpit and up through the bottom grating of the fire-place. A valve or damper is applied to close, or partially close, the opening into the flue at the upper part of the stove. *Patent abandoned.*

3406. J. Michaelis and J. Rubino. *Improvements in the construction of locks, catches, or fastenings for purses, bags, or other receptacles.* (A communication.) Dated December 20, 1862.

Provisional protection has not been allowed for this in- vention.

3407. J. Cowpe. *Improvements in machinery for tearing, breaking up, and reducing rags, ropes, waste fabrics, and other similar fibrous materials.* Dated December 20, 1862.

This invention is an improvement upon the common "devil" hitherto used for the purposes above-mentioned, and consists in a new combination and arrangement of mechanism for the purpose—viz., an endless feeder upon which the material to be operated upon is fed between a pair of fluted rollers which deliver it to a rotating cylinder pro- vided with teeth. The journals of the fluted feed rollers are held in stands or brackets, which also hold a pressing roller placed in front of the fluted feeding rollers, and resting upon the roller carrying one end of the feeding apron; these stands or brackets also hold the bearings of a roller covered with card or other teeth, which roller is placed above the top fluted feeding roller, the bearings of the said toothed roller resting upon the journals of the top fluted feeding roller; the fluted feed roller is weighted by a lever at each side, which act upon the bearings of the toothed roller; the same weighting levers also act upon the pressing roller in front of the fluted feeding rollers. The toothed cylinder is rotated so that its teeth act upwards from the fluted feeding rollers, and the toothed rollers rotated so that the teeth when operating will move in the opposite direction to those on the toothed cylinder. Bends are placed on the side frames of the machine opposite the upper half of the toothed cylinder, which serve to carry the ends of a series of bars or "flats" passing across the cylinder from one bend to the other; these bars or flats are fixed at intervals apart from each other, and are provided on that side opposite the toothed cylinder with a series of teeth. These bars or flats are so arranged as to be readily adjusted so that the points of their teeth may be brought nearer to or further from the points of the teeth of the cylinder. The toothed cylinder is cased or covered both above and below. When the materials operated upon have passed the last toothed bar or flat which is furthest from the feeding rollers, it may be carried out through a suitable opening by the current of air produced by the rotation of the toothed cylinder, or it may be driven by the said cur- rent against a rotating wire cylinder, and thus pass out in sheets between the wire cylinder and a roller working against it. This invention further consists in causing the material after it has been taken over the toothed cylin- der to be carried back under the cylinder, and delivered in sheets by a rotating wire cylinder and roller placed under the feeding apron. *Patent abandoned.*

3408. A. V. Newton. *Improvements in the manufacture of automatic toy figures.* (A communication.) Dated December 20, 1862.

The object of this invention is to impart to toy figures a natural walking or stepping movement, in lieu of that heretofore obtained by the use of wheels or rollers. This object is effected by the employment of a peculiar arrange- ment of double eccentric cam joints in connection with vertical or upright levers and pedal supports, whereby, through the medium of suitable clock mechanism, such reciprocating and alternating clock movements may be

given to the pedal extremities of the figure as will ensure the propulsion of the figure along a tolerably even surface. *Patent completed.*

3409. J. PLATT and RICHARDSON. *Improvements in scutchers or beaters of cotton, machinery applicable also to other machinery in which shafts are caused to revolve at high velocities.* Dated December 20, 1862.

This invention relates to a method of keeping the shafts of beaters or scutchers, or other rapidly-revolving shafts, cool; and for this purpose the patentees form the said shafts hollow and place water therein. *Patent completed.*

3410. W. PERKINS. *Improvements in the manufacture of a substitute for turpentine, which is also applicable to the manufacture of varnishes and to purposes to which turpentine is now ordinarily applied.* Dated December 20, 1862.

The inventor proposes to effect the purification of amyle or fusil oil, or of the oxides of amyle, by means of hypochloride of calcium, chromic acid, sulphuric acid, or any mixture of them in about equal proportions, and afterwards to effect the rectification or distillation of the same at a temperature of not less than 270 deg. Fahr. upon such bodies. He afterwards proposes to make an admixture of the aforesaid amyles with their equivalent proportions of liquid hydro-carbons from whatever source obtained. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated April 28, 1863.

1067. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in apparatus for preserving property in case of shipwreck. (A communication.)

Dated May 7, 1863.

1146. C. A. Day, A. Lamb, and T. Summers, Southampton, engineers. Improvements in marine engines.

Dated June 12, 1863.

1475. J. F. Toue, Newcastle-upon-Tyne, civil engineer. Improvements in the prevention of smoke in steam boilers and other furnaces. (A communication.)

Dated June 13, 1863.

1482. R. Blackburn, Exeter, engineer. Improvements in traction engines.

1485. J. S. Benson, merchant, and D. Jones, manufacturer, Birmingham. An improved construction of removeable head for casks, applicable to the closing of other vessels.

Dated June 15, 1863.

1498. R. W. Gordon, Belfast. Improvements in machinery for spinning flax and other fibrous substances.

Dated June 17, 1863.

1520. E. Wolf, Sambrook-court, Basinghall-street, merchant. A new or improved wrapper or wrapping material for use in smoking tobacco.

Dated June 18, 1863.

1525. J. L. Ganne, Cour Cheverny, France, engineer. Improvements in toy pistols.

1527. D. Barker, Milton-street, Wandsworth-road, corn merchant. Improvements in the treatment and preservation of yeast.

1529. E. Ivett, Bedford, brick and tile manufacturer. Improved machinery for the manufacture of tiles.

1531. E. Gossiaux, Laeken, Brussels, manufacturer. An improved machine for making bolts, rivets, and spikes.

Dated June 19, 1863.

1533. E. Howarth, cotton spinner, and J. Brown, machinist, Tonge, near Middleton, Lancaster. Certain improvements in apparatus for steaming cotton or other fibrous substances.

1535. R. Marrison, Great Oxford-street, Norwich, gun manufacturer. Improvements in breech-loading firearms.

1537. A. Morel, Roubaix, France, manufacturer. Improvements in machinery for combing wool and other fibrous material.

1539. J. Watts, Coventry, accountant clerk. Improvements in machinery or apparatus for the manufacture of malt.

1541. W. E. Newton, 66, Chancery-lane, civil engineer Improvements in the manufacture of leaden pipes. (A communication.)

Dated June 20, 1863.

1543. T. Smith, Tenter-lane, Leeds, millwright, T. Moore, Upper Mills, Wandsworth, and Major Murrell, King's Mills, Leeds, corn millers. Certain improvements in the construction of reels covered with silk or other suitable material used as machines for the purpose of dressing flour.

1545. D. D. Kyle, Victoria-street, Westminster. An improvement in baths.

1547. R. Brownlee, Glasgow, saw miller. Improvements in sawing machinery.

1551. J. L. Clarke, 45, Westbourne-terrace, Hyde-park. Improvements in apparatus for turning over the leaves of music and other books.

1553. F. Jenkin, Duke-street, Adelphi. An electric telltale compass.

1555. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in the construction of steam vessels.

1557. W. L. and T. Winans, Baltimore, United States, gentlemen. Improvements in adapting propellers for propelling ships or vessels for ocean navigation.

Dated June 22, 1863.

1566. F. Boult, Liverpool, merchant. An improved method or process for obtaining patterns and designs for the arts and manufactures. (A communication.)

Dated July 1, 1863.

1636. T. Boyle, 31, Gray's-inn-road, lighting and ventilating engineer. An improved system of ventilation applicable to every description of dwelling place and building.

Dated July 2, 1863.

1646. R. A. Brooman, 166, Fleet-street, patent agent. Certain compositions for protecting metals and metallic articles from oxidation, and for coating slate, bricks, pottery, and ceramic wares. (A communication.)

1648. E. Lloyd, 22, Wells-street, St. Marylebone. An improved composition for waterproofing, softening, and preserving all kinds of leather and articles made therefrom.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated July 8, 1863.

1701. G. Haseltine, 12, Southampton-buildings, Chancery-lane. Improvements in lever horse-power machines, the cog-gearing employed being applicable to other machines. (A communication.)

Dated July 13, 1863.

1752. H. A. Bonneville, 24, Rue du Mont Thabor, Paris, patent agent. Improvements in certain descriptions of breech-loading firearms. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, July 21, 1863.

629. J. Elsey. Winding of lace on to the work roller in warp lace, bobbin net, or twist lace machines.

640. T. Hancock. Receptacle for coins.

663. R. T. and R. Monteith. Making dyes from aniline and its analogues. (A communication.)

663. J. Cassell. Lamps. (A communication.)

666. H. Wilson. Machinery for shaping wood.

670. J. Werge. Indicating any regulated maximum or minimum degree of temperature. (A communication.)

671. J. Tomlinson. Machinery for opening twisted yarns and woven fabrics.

675. H. D. and J. W. Taylor. Finishing fabrics.

692. J. Page. Taps or valves.

695. R. Alexander. Mariners' compasses.

699. J. Walworth. Washing or cleansing and drying Egyptian wheat.

723. R. A. Brooman. Manufacture of spoons and forks. (A communication.)

724. F. and J. G. Richmond and H. Chandler. Washing vegetables.

727. B. Wren. Cleansing and treating certain descriptions of grain.

735. E. Lover. Composition for the coating and preservation of canvas and other materials.

745. J. and T. A. Nield. Core barrels.

746. R. A. Brooman. Beating and drying wool and other textile and filamentous substances. (A communication.)

795. G. Davies. Engraving upon metals. (A communication.)

885. J. N. Brown. Securing or connecting the bearing springs of railway carriages and waggons to the axle-boxes of the said carriages and waggons.

1070. R. Butterworth. Carding engines.

1212. A. Pilbeam. Sewing machines.

1269. G. R. Harding. Transmitting power on railways.

1390. J. J. McComb. Construction of presses for forming bales of cotton and other materials. (A communication.)

1447. W. Clark. Locomotive apparatus. (A communication.)

1513. W. H. Dawes. Manufacture of iron.

1574. C. T. Burgess. Reaping machines.

2602. R. Mushet. Manufacture of iron and steel.

1701. G. Haseltine. Lever horse-power machines. (A communication.)

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 17, 1863.

145. L. Verdure.	222. A. J. Sax.
177. J. W. Mears.	226. W. F. Stanley.
178. A. Phillips.	232. H. H. Henson.
192. H. Caro and J. Dale.	243. H. B. Barlow.
198. J. M. Binger.	260. H. Crichley.
206. J. Milner.	274. W. Clark.
210. F. N. Gisborne.	791. N. R. Hall.

Sealed July 21, 1863.

11. J. E. Baker and J. Landon.	342. J. Cameron.
209. C. Stopford.	400. W. C. Paul and A. T. Shore.
223. R. A. Brooman.	480. H. Mackinder.
237. W. Rollason, jun.	667. W. Wood.
239. J. Edmondson and T. Ingram.	786. G. F. Key.
241. D. E. Hughes.	929. R. Reeves.
261. B. J'A. Bromwich.	1251. J. H. Johnson.
273. G. Blake.	1256. A. Parker.
	1418. G. W. E. Friederich.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1701. S. C. Lister.	1779. G. H. Birkbeck.
1726. J. Fletcher.	1769. J. H. Young.
1730. A. C. Bamlett.	1772. M. A. F. Mennons.
1731. E. Loysel.	1810. T. and De G. Fowler.
1750. A. B. Woodcock.	1816. A. Gélis.
1754. J. Saxby.	
1764. C. C. J. Guffroy.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1661. W. Watt.	1674. T. Duncan.
1670. H. Turner.	1725. J. E. Hodges.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending July 18, 1863.

No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.
3272	1	0	3296	0	10	3309	0	4	3322	1	4	[illegible]	[illegible]	[illegible]
3283	1	4	3297	0	4	3310	0	8	3323	0	4	[illegible]	0	[illegible]
3285	0	6	3298	0	8	3311	1	0	3324	0	8	[illegible]	1	[illegible]
3286	0	8	3299	0	4	3312	0	4	3325	0	10	[illegible]	0	[illegible]
3287	0	6	3300	0	10	3313	0	10	3326	0	6	[illegible]	0	[illegible]
3288	0	6	3301	0	4	3314	0	8	3327	0	4	[illegible]	0	4
3289	0	4	3302	0	4	3315	0	10	3328	0	4	3341	0	[illegible]
3290	0	8	3303	1	10	3316	0	10	3329	1	0	3342	0	[illegible]
3291	0	10	3304	0	10	3317	0	4	3330	0	4	3343	0	4
3292	0	10	3305	0	4	3318	0	8	3331	0	4	3344	0	6
3293	0	4	3306	0	4	3319	0	8	3332	0	4	3345	0	[illegible]
3294	0	10	3307	1	2	3320	0	4	3333	0	8	3346	0	4
3295	0	10	3308	0	4	3321	0	10	3334	1	4			

NOTE.—Specifications will be forwarded by post [illegible] Great Seal Patent Office (publishing department [illegible] of the amount of price and postage. Sums ex[illegible] must be remitted by Post Office Order, made pa[illegible] Post Office, High Holborn, to Mr. Bennet Wood[illegible] Seal Patent Office, 25, Southampton-bldgs, Chancery-[illegible]

LATEST PRICES OF MATERIALS US[ED IN] CONSTRUCTION.

METALS.

IRON:—

		£	s.	d.		£ s.
Welsh Bars, in London	per ton	6	5	0	to	[illegible]
Nail Rods	do	7	0	0		[illegible]
Hoops	do	8	5	0		[illegible]
Sheets, single	do	9	5	0		[illegible]
Staffordshire Bars	do	7	10	0		[illegible]
Bars, in Wales	do	5	10	0		6 [illegible]
Rails	do	5	16	0		[illegible]
Foundry Pigs, at Glasg. No 1	do	2	14	0		[illegible]
Swedish Bars	do	11	10	0		12 [illegible]

STEEL:—

		£	s.	d.	£ s.
Swedish Keg, hammered ...	do	16	0	0	[illegible]
Swedish Faggot	do	17	0	0	[illegible]

COPPER:—

		£	s.	d.	£ s.
Sheet & Sheathing, & Bolts...	do	99	0	0	[illegible]
Hammered Bottoms	do	109	0	0	[illegible]
Flat Bottoms, not Hamrd....	do	104	0	0	[illegible]
Tough Cake and Ingot	do	92	0	0	[illegible]
Tile Copper	do	89	0	0	[illegible]
Best Selected	do	95	0	0	[illegible]
Composition Sheathing Nails	per lb.	0	0	10	[illegible]
Yel. Metal Sheathing & Rods	do	0	0	8½	[illegible]
Fine Foreign	per ton	97	0	0	100 [illegible]

TIN:—

		£	s.	d.	£ s.
English Block	per cwt.	6	2	0	[illegible]
do Bar	do	6	3	0	[illegible]
do Refined	do	6	8	0	[illegible]
Banca	do	6	11	0	[illegible]
Straits	do	6	6	0	[illegible]

TIN PLATES:—

		£	s.	d.	£ s.
Best Charcoal, I.C.	per box	1	8	6	[illegible]
Second Quality	do	1	7	0	[illegible]
Coke	do	1	3	0	[illegible]

REGULUS OF ANTIMONY:—

		£	s.	d.	£ s.
French star	per ton	42	0	0	[illegible]

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.		
Teak ...... load	£12	0	£13	0	Archangel, yellow ...	£13 [illegible]
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11 [illegible]
„ yellow pine .	3	10	4	10	Finlan	[illegible]
St. John, N.B., yellow	0	0	0	0	Memel	[illegible]
Quebec oak, white ...	5	10	6	10	Gothenburg, yellow	[illegible]
„ birch	3	10	4	10	„ white.	[illegible]
„ elm	3	10	5	0	Gefle, yellow	[illegible]
Dantzic oak	3	10	6	10	Soderhamn	[illegible]
„ fir	2	10	3	10	Christiania, per C., 12 ft. by 3 by 9 in.	
Memel fir	3	5	3	10		
Riga	3	0	3	5	Christiania, yellow	21 [illegible]
Swedish	2	10	2	15	Deck Plank, Dantzic, per 40 ft. 3 in.	[illegible]
Masts, Quebec red pine	5	0	6	0		
„ yellow pine	5	0	6	0	PUMICE STONE pr ton	[illegible]
Lathwood, Dantzic, fm	5	10	6	10	OILS, &c.	
„ St. Petersburg	8	0	8	10	Seal, pale ... per tun	[illegible]
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	[illegible]
					Cod	[illegible]
					Whale, Sth Sea, pale	[illegible]
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	[illegible]
St. John, white spruce	14	0	16	10	Cocoanut, Cochin...	[illegible]
Yellow pine, per reduced C.					Palm, fine	[illegible]
					Linseed	[illegible]
Canada, 1st qual. ...	17	0	18	0	Rapeseed Eng. pale	[illegible]
„ 2nd do......	11	0	12	0	Cottonseed	[illegible]

FRENCH & SMITH, Sworn Br[okers],
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number.—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 31, 1863.

THE BHORE GHAUT INCLINE.

A SLIGHT acquaintance with physical geo-raphy, is sufficient to inform us that very nany of the largest mountain chains, found in oth the Old World and the New, run parallel o the sea-shore at comparatively trifling dis-ances from those littoral regions, whose princi-al towns being seaports, act as the gates of vealth to the country at large.

Such is the character of the immense vol-anic range known as the Western Ghauts of ndia. Extending from Cape Comorin in the outh, almost to Surat in the north, over a dis-ance of nearly one thousand miles, it affords xamples of the most magnificent scenery in ne known world; while, savage, gloomy, nd inhospitable, it has for centuries, proved n almost inaccessible barrier to the develop-nent of the natural resources of the vast terri-ory which it effectually cuts off from all ommunication with the sea; all the benefits f commerce having been confined to a tract f country varying from 30 to 100 miles wide hich separates it from the coast.

Facilities for transport almost invariably rove the measure of the prosperity of a nation. Neither ancient history, nor modern statistics, ipply us with any exception to this rule. ncient Rome, modern England, alike owed nd owe their prosperity, and their might, to nat vast world of waters which offers a path the ends of the earth, and to those magni-cent roads which, penetrating the Continent in very direction, found a common centre in the etropolis of the world.

The enlightened Englishman of the 19th entury was not slow to perceive the advan-ages which proper means of transport would estow on our enormous East Indian posses-ons, and the extension of the railway system that country was early proposed. Its adop-on there, quickly placed in a most important ght the difficulties to free communication ith Bombay, occasioned by the Western hauts, or, to term them by their proper name, e Syhadree Mountains. The general cha-acter of this range is that of an abrupt volcanic carp, the height of the lowest part of the argin of which is about 2,100 ft. above the evel of the sea. From the line of its main irection various spurs project westwards into e Concan, and eastwards into the vast plain f the Deccan, which slopes gently to the other de of the peninsula. These spurs or ghauts orm inclined plains, descending from the ummit of the range by degrees—some-mes gradual, sometimes precipitous—until ey become lost in the level country elow. Little reflection is needed to show e serious injury to commerce caused y a natural obstruction to communication be-ween the interior of the country and the towns n the sea-coast. Steep and precipitous to a egree, the main body of the hills are practi-ally inaccessible, the only feasible places for n ascent being found in the spurs we have just entioned. For a distance of 220 miles, they re unsurmounted by any important path save e Agra road up the Thull Ghaut, and the oona and Calcutta road up the Bhore Ghaut. Were it not for these, Bombay would be cut off om direct communication with the interior. e track up the Bhore Ghaut is little more han a mountain pass, scarcely available for el carriages, travellers requiring two days, goods three, to traverse a distance of 48 miles. The Thull Ghaut road is somewhat better, but, even after a considerable outlay of money and engineering skill, it is still quite inadequate to meet the demands made on it by the traffic of the country. Besides these, there are a multitude of foot-paths and steep bullock-tracks, utterly worthless in a general sense, or at best, only capable of affording a means of local communication of the most insignificant value.

The magnitude of the interests involved is so great, and so thoroughly understood in commercial circles, that it requires no illustration at our hands. It is not, perhaps, too much to say that the benefits of such means of transit over these hills, between Bombay and the Deccan, as only a railway can afford, would not have been dear, had they been purchased at ten times the expenditure which the construction of the Bhore Ghaut railway incline has required. It is in many years hence that the vast benefits conferred by this line will be realized. The resources of the country which it opens up cannot be estimated, because we can but surmise the effects on its trade, which will be produced by good roads, railways, docks, harbours, and, in short, those magnificent works of civil engineering in which India is so deficient, though they are indispensable to her prosperity.

The first decided step towards the formation of a system of railways in India was taken by our Government in 1849. The Great Indian Peninsular Railway Company sprang into existence about the same time; and nearly the first proceeding undertaken by their engineers on their arrival at Bombay in 1850, was an examination of the different Ghauts within moderate distances of that city, which seemed most suitable for the construction of a railway over the Syhadree Hills. The Malsej Ghaut first claimed their attention; but a little examination showed that a route in this direction presented difficulties which, being almost insurmountable, led to its abandonment. The Bhore Ghaut was then the subject of a careful survey. This long spur, projecting a considerable distance into the plain, and rising by a comparatively easy gradient, possessed advantages which the closest examination failed to discover in other Ghauts.

The first result of a somewhat hasty decision was the laying out of a line, the length of which was about 13½ miles, with a total rise of 1,796 ft., or about 133 ft. to the mile, its cost being estimated at £483,900, the most objectionable feature being a stationary engine plane rising 1 in 20, and 1¼ miles long. Further operations, however, fortunately demonstrated that this might be avoided, by laying out a continuous locomotive gradient from the base to the summit of the Ghaut. The magnitude of the work, however, alarmed Lord Dalhousie, the Government being the guarantors for the necessary capital. A still more extensive and careful survey of the Syhadree range was determined on, and executed during the year 1853. Twelve Ghauts were surveyed, with a result which is best expressed in the report made by the late Mr. Berkley, chief engineer of the line at that time:—"For the purpose of laying out the South Eastern Line, I have now examined the Syhadree range, between the Malsej and the Sewta Ghauts, between the Deccan valleys of the Mokree and Neera; and upon the Concan, from the River Kaloo to the River Savitree (a range of 80 miles); and I certify that, to the best of my professional judgment, the Syhadree Mountains afford no place of ascent so eligible for the South-Eastern Railway as the Bhore Ghaut."

Although no better route could be discovered, yet the time expended on these surveys could not be considered thrown away. Mature reflection, and, perhaps, the experience gained by the explorers, led to a great improvement in the proposed line, which was again altered with the effect of flattening many of the gradients from 1 in 35, to 1 in 40 and 1 in 50; at the same time reducing many of the works to moderate dimensions. Subsequently, the reversing stations—one of which has since been adopted with great advantage—were proposed, other slight alterations in the route were determined on, which raised the level of the line where it encountered the heaviest ground, permitted the establishment of a station at Kandalla, and, in short, effected so many improvements, that its construction was at once entered on; a very few alterations being introduced during the progress of the work. The Bhore Ghaut, as now constructed, is 15¾ miles long; the level of the rails at its base is 195 ft. above the sea, and at its summit 2,027 ft., so that the total elevation surmounted by this incline in one long lift is 1,832 ft. Its average gradient is consequently 1 in 46·39, including the reversing station.

The works were commenced about the month of January, 1856, having been let by contract in the autumn of 1855, to Mr. Faviell; the constructive details being placed under the local superintendence of Messrs. Adamson and Clowser.

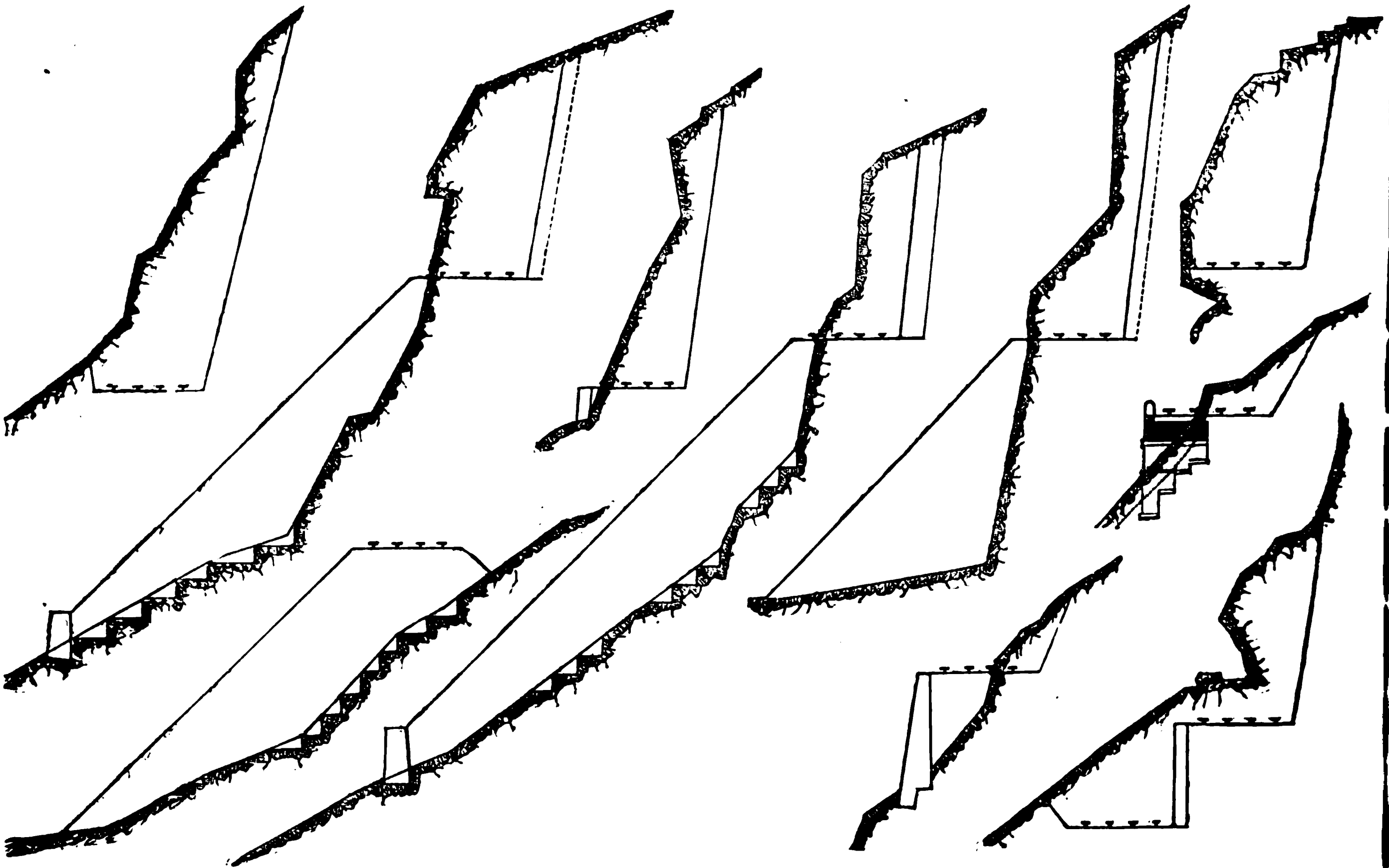
On the 14th January, 1858, the first portion of the incline (from the summit at Lanowlee to the station at Khandalla, a distance of 2¼ miles) was opened for traffic. Beyond the severity of the gradients, and a heavier amount of earthwork than usual—54,000 cubic yards of excavation being hard rock—there is nothing remarkable about this section.

In March, 1859, Mr. Faviell, from circumstances which it is not necessary to particularize, but which were chiefly brought about by the high price of labour, relinquished his contract. The amount spent up to that time was £210,000; but though much of the surface work had been done, the most formidable parts of the undertaking—the lofty viaducts, the tunnels, and the heavy cuttings through rock—were hardly commenced. The works were, however, carried on by the Railway Company's own engineers, Messrs. Adamson and Clowser, until the following November; when Mr. Solomon Tredwell, to whom the contract had in the meanwhile been re-let, commenced operations on a scale commensurate with the magnitude of the undertaking.

On the 15th of March, this gentleman entered on the works; only fifteen days afterwards, however, we regret to say, he was attacked by alarming sickness and died. His character and talents are well known; he was one of the most active and able contractors in England, and his decease was felt to be a public calamity.

Had it not been for the spirit and judgment displayed by Mrs. Tredwell, who in the midst of her affliction courageously entered on the contract, there is no saying how long the works might have been retarded. Misfortune followed misfortune. A little more than a month later, cholera broke out on the lower part of the Ghaut, and of 10,000 labourers employed on the first seven miles, only 1,000 were left after a fortnight had elapsed. Of the rest, many had been carried off by the disease; most had fled from fear of it. In February, the cholera subsided, and the effects of the visitation were being overcome, when it returned with redoubled violence in March. This time it prevailed throughout the whole length of the incline, and the progress of the wor almost stopped for the remainder of t

CROSS SECTIONS OF THE BHORE GHAUT INCLINE, OF THE GREAT INDIA PENINSULA RAILWAY.



Under these circumstances it was proposed to secure the services of Messrs. Adamson and Clowser, who had been the Company's resident engineers on this part of the incline from its commencement; and who, by a careful and liberal management during the time they had been carrying on the works for the railway company, had induced the labouring classes to look with favour upon the locality, and had overcome that previous scarcity of work-people which was the chief impediment to an efficient progress. A measure which was calculated to ensure the speediest completion of the incline, was also best calculated to promote the interests of the railway company; and with the permission of the directors, under the advice of the chief engineer, Mr. Berkley, they consented to take the management of the contract, and Messrs. West and Tate were appointed the resident engineers on the part of the railway company. Including these changes and several delays, the whole time occupied in the construction of this vast work has been about 7¼ years, under three distinct agencies at various times—under Mr. Faviell's contract for 3¼ years; by the railway company for 7½ months; and under Mr. Tredwell's contract (represented by Messrs. Adamson and Clowser) for nearly 3¼ years.

It is difficult for the engineer who has no experience of the system of railway work in India, to estimate the real difficulties encountered in constructing a first-class double line, specially intended for the heaviest traffic, up the side of a mountain, covered with dense jungle in many places; in others, encumbered with huge boulders resting on a soil swampy and treacherous to the last degree. The English engineer accustomed to the control of a well-organized army of "navvies," trained to work together with an almost military discipline, can form but a poor idea of the East Indian railway labourer carrying a few shovels-ful of earth in a basket on his head. Thus we learn from an able little pamphlet by Mr. West, C.E., which has afforded us much of the valuable information we lay before our readers, that the wheelbarrow, the most useful of all the machines employed in the construction of a railway, has scarcely been used; the greater part of the earthwork, having been basketed or carried by the native workmen. In order to give some idea of the magnitude of the works executed by such an apparently feeble agency, we give above a few cross sections of different portions of the line. Numbers and skilful direction compensated for any lack of individual power; and thus the history of the undertaking, is a record of a constant triumph over difficulties and dangers, which entitles the Bhore Ghaut Incline to rank as one of the most magnificent works ever executed by the ancient or modern engineer; and this, be it remembered, at a cost moderate in the extreme, when we compare the advantages gained, with the outlay to obtain them. Much valuable information is embraced in the following summary, from the pen of Lieutenant Swiney, Royal Engineers:—

"At the close of the working season of 1860, £123,000 had been expended by the contractors, making a total of about £350,000. During the same year the maximum number of workmen was 77 Europeans and 18,676 natives.

"The progress in the Bhore Ghaut during the following working season was quite unprecedented; owing to the excellent arrangements made by Messrs. Clowser and Adamson, even so early as October, 18,000 work-people had been collected. In November, there were 30,000; in December and January, 42,000; as much as £46,000 being expended per month in wages. By May, 1861, all the tunnels were in a forward state, and the progress in the viaducts and rock-cuttings was most satisfactory; and the engineers were able to speak with confidence as to the date of the completion of the work.

"The total expenditure then amounted to £600,000.

"During the following working season, the average number of workpeople employed on the Incline was about 25,000, the maximum number being 33,000 in January, 1862.

"The expenditure during this season was above £240,000; and the chief resident engineer reported in September, 1862, that there was every reason to expect that, by the end of March, 1863, the Incline would be opened for public traffic. This expectation has been realized almost to a day."

To enter into a detail of all the engineering difficulties encountered in the construction of this line would fill ten times the space we can devote to the subject, and we must content ourselves with a mention of one or two of the most important works executed.

In the original design were embraced 12 tunnels, their entire length forming 2,532 yards; 14 additional tunnels, making a further distance of 1,325 yards were substituted for cuttings during the progress of the work, in situations where the treacherous nature of the ground rendered the standing of the slopes doubtful. In some cases, the excessive hardness of the rocks rendered the operation of tunneling very slow; in others, a mixture of boulders, through earth otherwise moderately soft, rendered a masonry lining with all its attendant evils absolutely indispensable. Added to this in only two places were shafts practicable or advisable.

The viaducts are built of solid block-course masonry, up to the surface of ground, and above that of block-in-course

work, strongly tied to the internal work of sound rubble; all the arches are built of squared stone laid in courses, with ashlar arch quoins; not a brick has been used in any of the works on the contract.

At the village of Khandalla, the railway passes across an angle of the Tank, its formation level, 15 ft. below the highest level of the water. As the village and the Ghaut traffic, as well as the railway works are dependent upon this tank alone, for a supply of water, it was necessary to cut off the angle of the tank by a water-tight retaining wall 490 ft. in length, parallel with the railway line. By waiting until the level of the water had become low in the hot season, nearly half the length was built without much difficulty from the water; but for the remaining length of 270 ft. it was necessary to incur the expense of a coffer-dam. It was built in four lengths, the foundation averaging 10 ft. below the surface of the water when at its lowest level.

The lime used near Khandalla was brought from the Deccan, from distances of 20 to 40 miles. For the lower part of the Incline, lime from Bombay was used. Much of the sand had to be brought from distances varying from 4 to 10 miles.

The small springs which are to be met with occasionally, within a short distance of the railway, were not sufficient even to afford drinking water for the work-people in the hot season. For the centre and much of the lower part of the Incline, water for general purposes and for the masonry was brought up from the Oolassa on bullocks, a distance of 4 or 5 miles. The upper part of the Incline was supplied in the same way from Khandalla, and for a similar distance. By damming up one of the tunnels before the rains, it was converted into a reservoir, which afforded an ample supply of water during the following season, for the works in its neighbourhood. Pipes were also laid down, which considerably shortened the distance of carriage from Khandalla. It was necessary, however, to keep 1,500 bullocks constantly employed in the carriage of water alone, when the works were in full progress.

About 16 miles of cart road, and more than double that length of bridle and bullock paths, had to be constructed to give access to the works. A railway siding of nearly 2 miles in length, from Telowlee Station to Wonee, was also laid for the purpose of bringing up materials.

The reversing station is simply a means by which the direct ascent of the hill side is changed into one much longer and more gradual. It is so called because the engines being turned there, the tail of each train becomes the head during the remainder of its progress, and the train leaves the station in the same direction in which it entered it, but on a different level. At this station there is a very remarkable viaduct, the roadway being forked like the letter Y. The two diverging lines being inclined at different levels, while that part of the line represented by the tail of the Y is at the same level for both lines.

The gradients of the Bhore Ghaut Incline, which are all ascending, are as follows:—

	Miles.	Chains.
1 in 37	1	38·51
1 in 40	8	4·85
1 in 42	1	11·36
1 in 43·164	0	30·83
1 in 50	2	50·12
1 in 50·08	0	39·15
1 in 75	0	27·45
1 in 880	0	23·00
Level	0	75·74
Ditto, at the Reversing Station	0	20·50

The curves vary from a radius of 15 to 80 chains, an aggregate length of over four miles being straight. A comparison between this and the two most remarkable mountain inclines in Europe cannot fail to prove interesting.

The Giovi Incline, on the Turin and Genoa railroad, is 6 miles long, rising in that distance 889 ft., with an average gradient of 1 in 36, the steepest being 1 in 29; the sharpest curves being 20 chains radius. The Semmering Incline upon the Vienna and Trieste Railway has no less than 30 curves of 10 chains radius, with an ascent from Payerbach to Semmering, of 13¼ miles, rising in that distance 1,325 ft., with an average gradient of 1 in 47, and a descent from Semmering to Murzzuschlag of 8¼ miles, falling 705 ft., with an average gradient of 1 in 50.

The Bhore Ghaut Incline, with a total length of 15¾ miles, rises 1,831 ft., with an average gradient of 1 in 48, the steepest being 1 in 37. The above particulars are derived from a paper read before the Bombay Mechanics' Institute by its President, the late Mr. J. Berkley, C.E., in December, 1857.

The earthwork in cuttings and embankments amounts to 4½ millions of cubic yards.

Several of the embankments exceed 60 ft. in height, and many of the outer slopes are 150 ft. in length, and some of them as much as 300 ft. The greatest depth in the centre line of cuttings is 74 ft., and in one cutting the excavation on the upper side is nearly 150 ft. deep through solid rock!

On the 30th of March, 1863, seven years and three months after the beginning of the works, an experimental train, consisting of two Ghaut engines and their brake vans, were run through for the first time, running 13¼ miles, from Padusdherre to Khandalla in 52 minutes. The engines with which it is intended to work the Incline are fourteen in number, worked in pairs, by coupling them back to back; they are without tenders, carrying the water tanks on their own frames. Their principal dimensions are as follows:—Diameter of cylinder, 15 in.; length of stroke, 22 in. Each engine has two pairs of wheels, of 4 ft. diameter, coupled. Each engine has 160 tubes, of 2 in. outside diameter. The heating surface is equal to 1,055 sq. ft., of which 980 sq. ft. are in the tubes, 75 sq. ft. in the fire-box. Each tank contains 800 gallons. There is a skid-brake between the wheels on both rails. The total weight of an engine, when in working order, is about 34½ tons.

We have already given a notice of the opening of the Incline, on Wednesday, the 21st of last April; since then the regular traffic has been conducted with the greatest success, and, from the permanent character of all the work, there is every probability that it will so continue for a very long series of years, with an extremely moderate outlay on repairs.

It is worthy of note that this, the greatest railway work ever executed by English capital or enterprize, can scarcely be said to have been constructed for military reasons. Although it permits the despatch of armies to almost any part of the peninsula, this was regarded as a very secondary advantage by its promoters; and we trust that a long reign of peace may aid us to forget that it is applicable to such a purpose. A proposal was once laid before Alexander the Great for the construction of a colossal statue, to be hewn out of a mountain, on such a scale, that while one outstretched hand supported a city, the other should pour forth a river to water the plain below. The magnitude of such a work could only equal its absurdity. We more wisely hew mountains, not into statues, it is true, but, nevertheless, into memorials which, enduring for ages, will cease not to sustain cities and pour forth rivers of wealth on nations; such a record is presented in the passage of the Syhadree Mountains by the Great Indian Peninsular Railway.

MANUFACTURING MACHINERY WITH PROFIT.

It requires but a few minutes' walk through a mechanical workshop to fully comprehend that to make money by manufacturing engines or machinery, requires a combination of gifts and acquirements of no ordinary character. The prosperous management of such an undertaking calls for natural inventiveness, scientific ability, practical workshop knowledge, and commercial tact; these must be a combination of the inventor, the man of science, the workman, and the merchant at the head of the concern. To design the work always requires great scientific and practical knowledge, and sometimes high inventive ability. To turn the work out well and cheaply, a long apprenticeship in the shops is absolutely needed; while to get profitable orders in the face of rival competition, demands the mercantile shrewdness and smoothness of the practised salesman. Such a union of natural and acquired gifts has been seldom or never met with in one person. No wonder, therefore, that the number of those who have realized large fortunes by engine manufacturing can be counted on one's fingers. To make rails, pins, buttons, or bottles; to spin, weave, or print cotton, and to make these operations pay, requires little else besides commercial ability. The few profitable engineering undertakings have been those like Boulton and Watt's; where the commercial faculties of a Boulton worked in harmonious union with the scientific genius of a Watt.

Perhaps no great enterprize—and the successful management of an engineering manufactory is undoubtedly one of this character—can be conducted successfully without the application of the great principle of the division of labour. In the words of Adam Smith, "the greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgment, with which it is anywhere directed or applied, seem to have been the effects of the division of labour." This principle may be said to take the same rank in Political Economy as the Inductive Method in Physical Science. Both principles have been always more or less instinctively practised by mankind; but such intellects as those of Adam Smith and Francis Bacon were required to elaborate and distinctly enunciate their complete significance.

In these times of sharp competition, however, a division of labour in the management is not all that is required. We thus find that the really prosperous firms are those fortunate enough, or skilful enough, to also confine their trade in a special direction. It has been well observed that the happiest nations are those with the dullest histories. In the same way, the most fortunate engineering undertakings are those with the dullest practice; variety may be charming, but it is not always profitable, especially when it takes the shape of weekly wages to draughtsmen and pattern-makers. The maker who is able to confine his practice to special work, assimilates his position to that of a button manufacturer. There are few calls on him for expensive new experiments and designs; the interest and novelty of the work diminish, but his profits proportionately increase.

The first effect of narrowing the circle of variety in an engineering establishment is evidently to diminish the cost of getting out the estimates for tendering, and the book-

keeping expenses generally. Fewer drawings are then required, with their resulting new patterns and templets; all three most expensive items, and always locking up a large amount of capital. In shops doing a variety of work, a number of special foremen are required at the head of the different departments; a want unfelt when the work repeats itself day by day. The capital saved in such a way can be expended on special tools and machines; and the judicious use of these will alone often economize large sums for the proprietors. It is astonishing how far the use of special tools may be carried where there is a repetition of work. The different details can be accurately turned, bored, and tapped to special brackets constructed for the purpose, and the saving in quantity and quality of work by these means is very great. It is only by the use of these apparatus that the same class of engines or machines can be made exact counterparts of each other; thereby greatly cheapening and facilitating the repairs at any future time. The usual result of the division of labour is also seen in the great increase of dexterity in every particular workman; an effect which shows itself very forcibly by enabling a gradual reduction of the piece-work prices for different jobs. Another enormous economy—accelerating the operations of the whole establishment—is that of the saving of time "usually lost in passing from one species of work to another." There is even a division of the labour of the individual; and the difference between a good workman and a bad one is not always mere manual strength or dexterity, but rather a more or less complete recognition and adaptation of the division of labour principle.

To the adoption of this system, the great prosperity of the well-known works of Messrs. Platt Brothers, of Oldham, is greatly due. Before the unfortunate lull in the cotton trade, caused by the American war, nearly 5,000 men were there employed in manufacturing cotton machinery. Few managers are required at these works, but they receive a proportionately larger salary. The men—employed constantly on piece-work—were enabled to earn large wages, with profit to their employers. Machine labourers, at 15s. and 16s. a week, could do the work of 30s. turners and fitters at the special tools. The greater part of the work in the foundry is also done by special moulding machinery.

The well-known works of Clayton and Shuttleworth, of Lincoln, which are confined almost entirely to the manufacture of portable and fixed agricultural engines and thrashing machines, are managed on the same principles. The Gorton Foundry, near Manchester, conducted by Mr. C. F. Beyer, for many years the manager of the Atlas Works, Manchester, is considered a model establishment in every respect—management, system, and work turned out. Little else than locomotives, and tools for manufacturing that class of engines, are made at these works; and perhaps no other workshops can be cited as having acquired so high a standing within such a short period.

Now that many branches of mechanical engineering are getting consolidated in form, and are becoming, to a certain extent, less susceptible of alteration and improvement—*e.g.*, cotton machinery—there is an imperative necessity for any firm wishing to play a large part, to concentrate its trade as much as possible. The houses that fail to do this, will be inevitably distanced by their fellow competitors. Several shops in Lancashire, where locomotives were manufactured a few years ago, have been driven out of this market by the establishments specially organized for this class of work.

If, from a short-sighted greed of gain, orders of an uncommon description be accepted for which even a fancy price be given; even if they bring in a large *direct* profit; nevertheless, by their uncommon character, the profit on the usual work of the shop is lessened, from the derangement of the ordinary course of proceedings. Losses of this description can be ascertained with difficulty—if at all—from the books; while they are often much greater than is imagined by some people. Just as the vast extension of human knowledge has rendered a modern Admirable Crichton an impossibility; just as professional success in the individual imperatively requires the elaboration and adoption of some speciality; so also is it impossible for an engineering establishment to succeed in a variety of things; while the delivery of a second-rate article will often injuriously affect the sale of other manufactures in which the same firm may even happen to excel all others.

At the same time, a narrow range of articles manufactured in any establishment, has a tendency to contract the ideas of the managers; an effect which often conspicuously shows itself when any arrangement be undertaken out of the ordinary line. The pupils and apprentices have also a better chance of learning their business in shops where multifarious kinds of work are executed. Again, there is a danger in executing everything by "piece-work;" a plan to be only fully carried out when there is little variety in the work done. The men are continually tempted to "scamp" their work, and quality is not always obtained in union with quantity. Nevertheless, payments by the piece are the only means of "paying by results" in a workshop—in all cases and situations the most equitable and profitable for both employer and *employé*. As a rule, with "daywork" the *men* have to be looked after, in order to obtain quantity; with "piecework" the *work* itself has to be strictly inspected, that quality may not lag behind. The safest plan when machines are manufactured by "piecework," is to submit them to a thorough practical test; to put them—while still in the hands of the erectors—to the work they are intended to perform when delivered.

It sometimes happens that a firm of long standing in the engineering trade finds itself greatly committed to a variety of work; and other firms, starting later, and thus unfettered in the many ways in which an old establishment is bound, often get the start in special descriptions of machinery. This might, perhaps, be met by a regularly organized system of giving out any unusual orders on commission or in exchange for others of a more suitable description. This plan is carried out by several eminent firms in Lancashire. Some of these establishments also derive a regular trade in designs by selling, at a high price, sets of tracings of any engines or machines that happen to have been completely drawn out on paper. An old firm could often get a profit in this way out of many of the patterns and designs that would otherwise uselessly depreciate by age, and by the continual progress in all things mechanical. With a proper contract, carried out by a strict inspection, as good—or even better, and most certainly cheaper—work could be delivered if the sub-contractors be properly chosen.

THE ROYAL AGRICULTURAL SOCIETY.

THE MEETING AT WORCESTER.

(*From our Special Correspondent.*)

CONSPICUOUS in the midst of the agricultural implements, a great variety of hydraulic apparatus was also exhibited; amongst which we noticed the peculiar pump exhibited by Mes Norton. Its construction is well explained the name by which it is known. The "V shaped pump, then, instead of having a cylinder, and plunger or piston, which is const wearing loose and becoming leaky, has a bed, with a sliding V piece working there without packing. We have already fully described this admirable pump in the MECHANIC MAGAZINE for April 24, 1863; the inven really deserves the high character it has received from those who have tested its meri

Messrs. Merryweather exhibited their well known steam fire-engine "Torrent." Although there were no facilities for a full display of its capabilities, its steam was got up and it was kept at work pumping water from one tank to another. After the close of the show, the engine was tried in the city be several of the authorities, who expressed themselves much pleased with its performances.

Messrs. Warner exhibited a great variety hydraulic machines. Amongst other arti we noticed a large double-action pump moun on wheels (this pump has been purcha for India); also a double 6 in. pump work by steam, throwing about 120 gallons a min and a great number of other articles, all displaying that excellence of design and workmanship for which the firm is so justly celebrated.

THE TRIALS.

The following is the continuation of the report on the trials; which we were oblig omit last week from want of space*:—

The Steam Cultivators.—The prizes offe for this class of implements consisted of and a gold medal for the best applicatio steam power for the cultivation of the soil, of £50 for the best application of steam po which may be effectually and safely adapted small occupations. The judges were th agricultural gentlemen—Mr. Jacob Wi (Northumberland); Mr. C. Sewell R (Norwich); Mr. H. B. Caldwell (Wilt assisted by Mr. William Owen, a Rotherha engineer. As usual, Mr. Fowler got the li share of the prizes. For his large steam tac he received the gold medal and £30; the remainder (£20) going to Mr. Savory. Of th prizes for small steam tackles, Mr. Fowler received £25; Mr. W. Smith (Woolston), £1 Mr. Howard, £10; Mr. Stevens, one of ten silver medals devoted to miscellane awards; while Mr. Coleman was "commende The decision regarding the Bedford firm caus some surprise, as their system embodies considerable mechanical improvements over th of Mr. Smith of Woolston. Collinson Hall a Hayes, of Stoney Stratford, were also com petitors in this line. In the show yard Be of Stow, exhibited a combined steam plo consisting of an iron frame on wheels, at e end of which were attached ploughs hung joints, and to be lifted from the ground by wheel and pinion. Fisken, one of the origi inventors of the balance-plough and self-act anchor, showed both these articles at Sta No. 165. Mr. Williams (Wilts) made appearance with a steam plough forme three wrought-iron frames, holding coulters on separate centres, independen the outside frame.

Mr. Fowler, in the course of the trials, employed his three different systems—the si traction engine, with its clip-drum and s acting anchor; then two engines on the oppo site headlands; and lastly, the plan he brou out last year for working small occupat by means of a portable engine. He us

* At page 522 of our last number, and at the 13th from the bottom of the first column, there is a self-e misprint of "*engine*" for "BRAKE."

one of Clissold's bevel-edged belts (described in our number for March 20, p. 214), for communicating the motion from an ordinary portable engine to a carriage in front, supporting a clip-drum, and working a self-acting anchor at the opposite headland. Fowler's usual balanced tool was used by himself, and by Savory, Collinson Hall, and Hayes.

Hayes, of Stony Stratford, used a similar implement to the one he exhibited in the Eastern Annexe of the International Exhibition. It consists of a 10-horse stationary engine and a windlass, the winding-drums of which are driven by a strap, which can be shifted at pleasure, thus doing away with objectionable gearing. He uses cords laid along the fields, for altering his windlass by the man at the anchor. There is no doubt that Mr. Hayes' system has great merit, and it is certainly very ingenious. Unfortunately, this tackle came to grief on the very first day of trial (Wednesday, 15th), through a coil of rope getting accidently caught in the gearing of the windlass, and thereby smashing nearly one-half of the drum.

Mr. Collinson Hall appeared with one of Turner's 10-horse traction engines, working his steel chain upon a polygonal drum. The chain is formed of circular steel rods and short flat plates riveted at the joints. There is a difficulty in keeping it off the ground, that must add to the consumption of power of the engine, and the wear and tear of the chain; and the whole apparatus did its work rather slowly, from the machinery for setting the rope to the variations in length of the furrow being as yet incomplete. He used Fowler's plough and anchorage. The steel rods of Hall's peculiar chain were about 18 in. long, and ¾ in. in diameter, being riveted to 4-inch plates. They are stated to cost nearly £7 10s. per 100 yds., and to weigh about 1 lb. per lineal foot.

Mr. W. Smith, of Woolston, worked his 3-tined cultivator and windlass with a double cylinder 10-horse engine of Butlin, of Northampton. It at present combines a cultivator and drill, weighing nearly half-a-ton less than the one exhibited at Battersea last year. The framing is balanced on a pair of wheels, and the whole implement is very manageable. The windlass and grubber were worked by Mr. Smith's usual well-known tackle.

Mr. Steevens, of Hammersmith, competed with a Howard's tackle, driven by a traction engine of Garrett of Leiston. His plough may be shortly described as being a great improvement upon the Fisken plough, described in the famous patent, No. 1629, year 1855. The two sets of ploughs balance each other, and they are raised and lowered by a screw and toothed segment. It is a very neat and well-arranged implement, and it does credit to its manufacturer, Mr. Woodbourne, of Kingsley.

Messrs. Howard, of Bedford, worked their double-framed cultivators with one of Clayton and Shuttleworth's 10-horse double-cylinder engines and the usual stationary windlass with coiling chains; the rope laid all round the field, and the slack rope being kept off the ground by means of their ingenious double compensating snatch block.

Coleman and Sons brought their two cultivators, worked by their 10-horse double-cylinder engine. In this system, two implements are alternately pulled between the engine at one headland, and a light anchored pulley on the opposite headland.

The steam cultivation system that attracted the most attention, from its novelty and originality, was that of Messrs. Savory and Son, of Gloucester. They employ two 10-horse power double cylinder traction engines at the opposite headlands. A 6 ft. drum—capable of taking in at one lap 570 yards of rope—is hung upon friction rollers on the boiler barrel of the engine. The rope is fed on to the drum by a pair of small rollers, worked to and fro on a screw shaft. Each engine alternately draws the implement towards it, while the other is running free and advancing along the headland in position for the next furrow. This system is very ingenious, and well deserves the prize it has received from the Royal Agricultural Society. Whether it will keep its ground is a different question. We did not see any arrangement for taking up the wear between the friction rollers and the inside of the drum, nor would any appliance with this intention be very feasible. There must also be a considerable strain upon the boiler seams, and we should say that there must be occasionally some waste of power when the screw passing the rope on to the drum gets slightly ahead of its work.

Mr. Fowler's double engine seemed to us to be equally efficient with Savory's plan, without its drawbacks. Each of the 10-horse power traction engines was furnished with a common vertical winding-drum underneath, with a very simple contrivance for coiling the rope. The double cylinder arrangement is evidently the best for large occupations, and for doing work by contract. Fowler's apparatus of that class adapts itself remarkably well to fields of irregular shape—the rope coiling easily on the drums at any angle.

In a full account of the trials of the steam cultivators, the usual chapter of accidents would take up a large share. On the first day (Wednesday) Fowler burnt out his fire-box plug, from the water getting too low, before he had completed his 1½ acres of ploughing. Collinson Hall was disabled before reaching the ground. Steevens could not work, through several mishaps. Messrs. Coleman's cultivator also met with an accident; and Hayes completely disabled his apparatus for the remainder of the trials. Smith did his work slowly, but well, and Howard made excellent work with his cultivator. Savory very rapidly completed his 1½ acres with one of Fowler's ploughs, manufactured by the Messrs. Ransome. On Thursday, Coleman again broke his cultivator. Fowler, employing three men and three boys, and using 3 cwt. 3 lb. of coal, did 2 acres in 1 hour 57 minutes. Howard, with four men and two boys, grubbed up the same extent of land in the same time; while Savory, employing three men and one boy, and also using Howard's 3-tined grubber, accomplished a similar performance in 1 hour 41 minutes. The latter lost about ten minutes through accidentally breaking an eye off his rope. On Friday, we saw Mr. Fowler doing some extraordinary work, breaking up with his 12-horse engines and digger a soil that looked like a surface of cast-iron; and his plough worked through, turning up solid 12 inch cubes of earth. He did 1 acre 3 roods and 28 perches in 2 hours 33 min., consuming 5 cwt. of coal. Coleman again broke his cultivator, but afterwards did some excellent work. Steevens' plough, worked by Savory's engines, also did some very good work. The general results of the trials seem to be a triumph for the direct-acting system, exemplified in Fowler's and Savory's double-engine plan. The saving of rope, the economy of time in adjusting the tackle, and the general simplicity of the mechanism seem to point to this plan as the steam tackle of the future. If an arrangement could be successfully carried out, for employing the portable engines in this manner, by making them self-propelling, it would no doubt meet with great success in all steam-ploughing operations.

Mr. Amos employed a novel and simple dynamometer, of his invention, for testing the draught of the steam ploughs. It consists of a piston, in a cylinder partly filled with water contained in an india-rubber bag, the bottom of which is between the two discs forming the piston. The edges of the bag are also tightly bolted between the cover and the cylinder, thus forming both the piston and cover joints. One of Bourdon's gauges is screwed on the cover. A hook being fixed to the bottom of the cylinder, and a second hook to the piston, the strain at both ends causes the pressure given out by the piston on the water to be communicated to the Bourdon gauge. This instrument only requires a registering apparatus, to render it complete. The ground, however, where these trials were conducted, was so clayey and indurated, that accurate dynamometric experiments were scarcely practicable; partly from the jerking action; and, on the other hand, from the difficulty of ascertaining the real depth of the work.

The Thrashing Machines.—These barn implements are not much altered in construction from those exhibited at Battersea last year. As we observed in our last, Bruckshaw and Underhill's elevator seems to be getting into more general adoption, but the machines provided with this apparatus gave rather unsatisfactory results at the trials. In fact, the machine of the latter exhibitor was unsuccessful through the choking of the patent elevator. The blast, however, in its various forms, is sure to spread in its applications; and there is no better means of simplifying combined thrashers, or one that offers a better prospect to those determined to simplify the thrashing machine—*coute qui coute*.

Those useful appendages, Coulson's patent wood spring hangers are also getting largely employed, and their use evidently diminished the number of working parts and the strain on the framing of the machines. The machines were driven by one of Clayton and Shuttleworth's 8-horse engines. The thrashing machine judges were:—Mr. Gibson Martin, Thorney, near Peterborough; Mr. Wm. Chalcraft, Brimsholt House, Lephock, Hants; and Mr. John Hicken, Bourton, near Rugby. One hundred sheaves were allotted to each machine, 15 being allowed for bringing it into working order. The points for the consideration of the judges were:—the time taken by each machine for thrashing the hundred sheaves, the cleanness of the sample, and the engine power consumed. The samples were not tested by the judges by screening and weighing, as at Chester—a rather rule of thumb mode of procedure. As will be seen, the machines were very numerous, and in some cases the judges allowed a second or third run when any misfortune occurred. This caused some dissatisfaction in the competitors of the machines so favoured. The prizes offered consisted in £50 for the class of portable combined steam thrashing and finishing machines, and £20 for similar fixed machines.

An exhibitor showing two machines differing essentially in principle, was allowed to try both. The general results are given in the following table:—

TABLE No. 1.

Combined Finishing Thrashing Machines.

Name of Exhibitor.	No. in Catalogue.	Time in which each Machine thrashed 100 sheaves of wheat.		Average Horse-power required by each Machine.	Horse-power that would be required to thrash 100 sheaves in one minute.
		min.	sec.		
Stoother	3,[illegible]	6	55	10·11	61·95
Bradshaw.........	3,798	4	59	6·55	32·82
[illegible]	1,524	4	30	7·76	34·94
Barrett and Co.	2,540	5	25	6·44	34·92
Tuxford	5,016	3	55	8·85	34·68
Tasker	1,013	5	55	4·52	26·746
Clayton and Co.	153	5	25	6·94	37·623
Wallis and Co.	1,071	3	50	8·52	32·651
Barrows	204	4	25	6·03	26·65
Hornsby	1,955	4	25	6·83	30·38
Hornsby	1,956	4	0	7·73	30·95
Clayton and Co.	144	3	55	5·71	22·37
Clayton and Co	144	4	10	6·0	25·02
Marshall	5,765	3	10	9·79	31·
Sakler............	540	4	0	6·95	27·83
Gilbert	1,551	5	5	7·7	39·16
Fildes	520	5	35	6·83	38·17
Underhill.........	5,085	Machine choked twice. Experiment discontinued.			
Parsons.........	5,247	4	30	8·05	36·25
Tasker	3,057	3	25	11·28	38·547
Humphries	1,007	4	40	8·18	38·175
Robey	4,826	5	55	8·88	52·488
Ransey	1,277	4	5	8·79	35·88
Holmes	1,822	6	3	8·03	52·22
Underhill	5,284	4	8	8·9	36·78

Seven of the machines in the above table were weeded out; and each machine received 500 sheaves for the experiment, and 20 for getting the machine into running order. The results are given in the following table. The division of the £50 marks the relative order in merit of each machine in the opinions of the judges:—

TABLE No. 2.

Combined Finishing and Thrashing Machines. Selected and Frictional Trials.

Name of Exhibitor.	No. of Article in Catalogue.	Time in which each Machine thrashed 500 sheaves of wheat.	Average horse-power required by each Machine.	Horse-power that would be required to thrash 500 sheaves in one minute.	Horse-power required to drive each Machine empty.
		m. s.			
Tasker	3,057	23 30	9·99	235·34	5·778
Wallis & Co., £10	1,071	15 50	9·6	152·96	5·535
Holmes, silver medal	1,829	22 0	10·235	225·187	6·817
Robey	4,826	18 35	8·7	161·797	6·1542
Clayton & Co., £15	144	22 10	7·78	172·35	3·911
Hornsby, £25......	1,955	17 36	9·66	170·05	4·8
Barrett & Co.......	2,540	20 55	8·49	177·44	4·089

N.B.—Each machine was run empty for 5 minutes, and the result recorded as per last column.

In the class of fixed barn-works, four machines were exhibited, two of which were weeded out—one of them relinquishing the trial from some derangement in the dressing apparatus. According to the expressed opinions of the judges, the winning machine left nothing to be desired in the work it accomplished.

TABLE No. 3.

Fixed Barn Works.

Name of Exhibitor.	No. in Catalogue.	Time in which each Machine thresbed 250 sheaves.		Average horses' power required by each Machine.	Horses' power that would be required to thrash 100 sheaves per minute.	Horses' power required to drive each Machine empty.
		m.	s.			
Humphries.........	1,008	16	40	5.59	93 29	—
Clayton & Co.......	145	12	55	5·83	75·39	—
Hornsby, £20......	1,958	9	30	8·34	79·26	—
Barrett...............	2,541	10	35	8·53	90·3	—

Renewed Trial:—

		Time with 500 sheaves.			
		m. s.			
Hornsby, prize ...	1,958	16·5	9·25	148·837	3·58
Clayton and Co...	145	Strap having come off trial was discontinued			3·93

N.B. The Machines were run empty during a period of 5 minutes. In all these tables 1 horse-power is taken as being equal to 33,000 lb. lifted 1 foot high per minute.

The power consumed in driving the thrashing machines was ascertained by means of an ingenious dynamometer, constructed at the works of Messrs. Easton and Amos. We hope to be enabled to give an illustrated description of this interesting apparatus, and, in the meantime, we will shortly describe its general arrangement:—The pulley driven by the strap from the engine was attached by means of four curved springs to the pulley driving the thrasher. The springs are graduated to 153 lb. at the circumference of the pulley. When—through any extra strain on the thrasher—this pressure is exceeded, the pulley driving the machine gives way, and, being loose, it turns round on the shaft. A double circular inclined plane, fixed to the loose pulley, revolves with it, and, pressing on a spring, it thrusts forward a small spindle fitted inside the shaft. To this spindle a small smooth disc is fixed at right angles, and it presses against another larger disc. This latter is caused to revolve by a train of wheels; a continuation of the same train forming a counter for the registration of the number of revolutions of the engine. When the small disc is at the centre of the larger one, no motion is produced, and of course no registration is then required. On its being in the least thrust out of the centre, however, it is caused to revolve by its friction against the larger discs, and it then transmits its motion to a square spindle upon which it slides. This spindle again communicates its movement to another train of wheels, forming a second counter, upon which, at the end of the operation, the total amount of the power consumed can be read off. The small disc is thus, in its normal position, at ⅛ of an inch from the centre of the larger one; and in that position it represents a pressure of 153 lb. So delicate is this apparatus, that the different stages in the feeding in of the sheaves were very plainly indicated.

According to Mr. Amos, the thrashing machines generally were of a higher order of construction and workmanship than any exhibited at previous shows. The corn-dressing machines were not tested with regard to the power consumed—by means of the dynamometer; as, through an unfortunate omission, the exhibitors were not previously requested to have these machines provided with the exact diameter of pulley required by the instrument.

We must now conclude our notice of the Worcester Show; at the same time regretting that we have not more space at present to devote to the subject.

TRIAL OF THE "MANHATTAN."

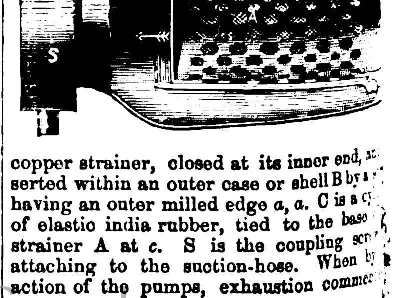
THIS engine, which has received a partial repair at the hands of Messrs. Shand and Mason, underwent some experiments on Saturday, in the presence of a numerous body of engineers and others concerned in such matters. The trials were conducted at the Shadwell entrance to the East London Docks; the site was extremely convenient for testing alike the drawing and forcing powers of the machine, the vertical distance from the rotary pump to the surface of the water in the basin being nearly 15 ft. Steam was got up a little after 1 o'clock; the times and pressures were nearly as follows:—In 1[...] from the application of the match, the [...] got to work with steam at 20 lb., drawing [...] immediately, without priming the pump; in [...] the pressure was 40 lb.; in 15 m. 45 lb., [...] the engine was stopped for a short tim[e] [...] 15½ m. the pressure was 55 lb.; in 16 m. [...] at 62 lb. the engine started, throwing [...] steady jet through a 1¼ in. nozzle to a di[stance] of about 150 ft., with a pressure in the air-[vessel] of about 80 lb; in 18 m. 40 s. a pressu[re of] 100 lb. was reached, with 140 lb. in the air-[vessel]. The engine making about 280 revolutio[ns per] minute, some very fair work was done; [at] this juncture a leak was sprung in the b[oiler], which, though very trifling, so far damp[ed the] fire as to render it impossible to keep [...] After a little time the leak stopped itself, the fire was re-lit, but without producing very good results. Whether from a defect [in the] quality of the coal, or that the boiler has [been] more injured than appears at first sight, [it was] found impossible to keep up the water [...] and the pressure in the boiler at the same t[ime], the introduction of the feed pulling dow[n the] pressure with a rapidity which was very re-markable. The engine and pump of the ma[chine] leave little to be desired; but the boiler [...] cannot accomplish better results than [...] have seen, must, we fear, be pronou[nced a] failure. After a couple of hours, the coal [pro]vided having been consumed, all further [...] ceased, the engine returning to London.

Captain Shaw, of the London Fire Br[igade], gave a very handsome entertainment th[e] evening, at Watling-street, to Mr. Van T[...] the other American gentlemen who accom[panied] the engine from New York. About twe[nty] of his own men were present, in compa[ny with] many gentlemen well-known for the in[terest] they take in all that appertaineth to fire [and] their suppression. The Duke of Suth[erland] honoured the board with his presence [...] evening. The large hall, usually devoted [to the] reception of the engines, was converted [into a] handsome tent by a skilful arrangement of [...]ing. With such a host as Captain Shaw, w[e need] not dwell further on an act of hospitality [...] was a courtesy, in the fullest sense, gra[...] paid to foreigners who well deserved it.

BADDELEY'S VALVED SUCTION STRAINER.

IT is well known, that when pumps or fire-en[gines] are lifting water from great depths, a [...] slight defect in any part of the suction-pi[pe or] its joints occasions much trouble and [annoy]ance, especially if the engine discontinues [work]ing for a short time, as the whole of the [water] immediately runs out of the pipe, and wh[en the] engine resumes working, has again to be [drawn] from its original low level. To obviate [this a] foot valve has sometimes been placed at th[e bot]tom of the feed-pipe. Mr. Baddeley, C.E. [has] recently designed and registered a valved s[trainer] for fire-engines, &c., which was successfu[lly em]ployed in the late trial of steam fire-eng[ines at] the Crystal Palace.

The accompanying drawing is a section[...] of this strainer. A is a cylindrical per[forated]



copper strainer, closed at its inner end, an[d in]serted within an outer case or shell B by a [...] having an outer milled edge *a, a*. C is a cy[linder] of elastic india rubber, tied to the base [of the] strainer A at *c*. S is the coupling scr[ew for] attaching to the suction-hose. When b[y the] action of the pumps, exhaustion comme[nces]

ıotion-pipe, the water rushes through the rations of the strainer, distends the india ır, and passes up the suction-pipe to the ıs. If the working of the engine is stopped, ıdia rubber closes round the perforations prevents the return of any water through ; by this means the column of water is tained, for any length of time, close up to uction valves of the engine, and no loss of ensues when the engine resumes working.

ɜITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

thirty-third meeting of the British Associa- for the Advancement of Science will com- ce in Newcastle-upon-Tyne, on Wednesday, 26th of August, 1863, under the direction of following officers:—President:—Sir William Armstrong, F.R.S. Vice-Presidents:—Sir ter Trevelyan, Bart.; Sir Charles Lyell, D., D.C.L., F.R.S., F.G.S.; Hugh Taylor, .; Isaac Lowthian Bell, Esq.; Nicholas od, Esq.; the Rev. Temple Chevallier, B.D., .A.S.; William Fairbairn, Esq., LL.D., .S. General Secretaries:—William Hopkins, ., M.A., F.R.S., St. Peter's College, Cam- dge; John Phillips, Esq., M.A., LL.D., F.R.S., ofessor of Geology in the University of Oxford, iseum House, Oxford. Assistant-General Se- ıtary:—George Griffith, Esq., M.A., Deputy ofessor of Experimental Philosophy in the Uni- rsity of Oxford, Jesus College, Oxford. General easurer:—William Spottiswoode, Esq., M.A., R.S., F.G.S., F.R.A.S., &c., 19, Chester-street, ılgrave-square, London, S.W. Local Secre- ries for the Meeting at Newcastle-upon-Tyne: Captain Noble, Augustus H. Hunt, Esq., and . C. Clapham, Esq., 5, Grey-street. Local reasurer for the Meeting at Newcastle-upon- yne:—Thomas Hodgkin, Esq.

The General Committee will meet on Wednes- ay, the 26th of August, at one p.m., for the elec- on of sectional officers, and the despatch of usiness usually brought before that body. On ıis occasion there will be presented the report f the Council, embodying their proceedings uring the past year. The general committee vill meet afterwards by adjournment.

The first general meeting will be held on Wed- ıesday, the 26th of August, at 8 p.m., when the President will deliver an address; the concluding meeting on Wednesday, the 2nd of September, at 3 p.m., when the Association will be adjourned to its next place of meeting.

At two evening meetings, which will take place at 8 p.m., discourses on certain branches of science will be delivered.

There will also be other evening meetings, at which opportunity will be afforded for general conversation among the members.

The Committees of Sections will meet daily, from Thursday, the 27th of August, to Wednes- day, the 2nd of September inclusive, at 10 a.m. precisely.

The Sections will meet daily, from Thursday, the 27th of August, to Tuesday, the 1st of Sep- tember inclusive, at 11 a.m. precisely.

The following are the titles of the sections to which communications may be presented:— Section A. Mathematics and Physics. B. Chemistry and Mineralogy, including their applications to Agriculture and the Arts. C. Geology. D. Zoology and Botany, including Physiology, Sub-Section D. E. Geography and Ethnology. F. Economic Science and Statistics. G. Mechanical Science.

Notices of communications intended to be read to the Association, accompanied by a statement whether the author will be present or not at the meeting, may be addressed to George Griffith, Esq., M.A., Assistant-General Secretary, Jesus College, Oxford; or to Captain Noble, Augustus H. Hunt, Esq., and R. C. Clapham, Esq., Newcastle-upon-Tyne.

The iron-clad "Roanoke," supposed to be the most formidable vessel in the Federal service, has proved a failure for sea-going purposes, and has been retained for the defence of New York Harbour.

HOLDEN'S APPARATUS FOR WASHING WOOL.

FIG. 1.

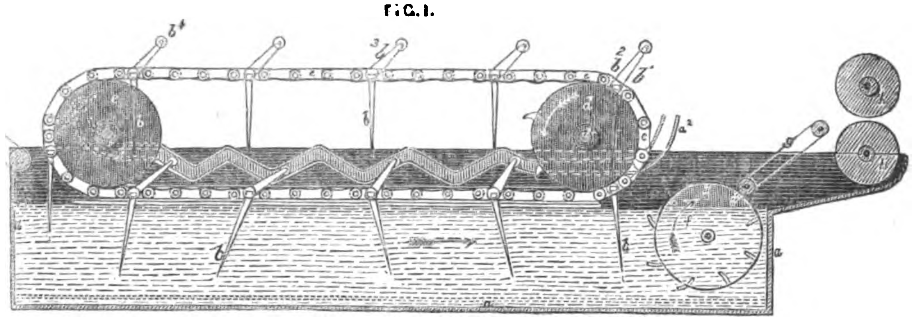
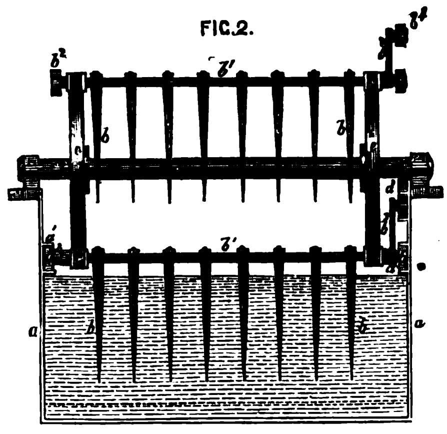


FIG. 2.



HOLDEN'S APPARATUS FOR WASHING WOOL.

The following improvements in machinery for washing wool have been recently patented by Mr. Isaac Holden, of Bradford. The invention relates to means by which the fibres are operated upon whilst being conducted through the trough of wash liquid by prongs, grates, or other surfaces adapted to conduct the fibres in effecting the washing thereof, and have for their object to effect an intermittent forward and partial retrograde action to such means. For this purpose the prongs, grates, or other instruments may be applied to plates or bars, or carriers, which are controlled to move in irregular courses, or in courses with alternate progressive and retrograde action, by which such instruments, during their progressive motion, will effect a forward and partial backward action to their points or operating ends upon the fibre.

Fig. 1 shows a longitudinal section, and fig. 2 a transverse section, of apparatus for washing wool and other fibres with parts arranged according to this invention.

a, a is the bowl or trough of wash liquid in which is placed the fibre to be cleansed. The wash liquid is supplied to this bowl or trough by any suitable means, and the fibre to be washed is fed thereto at the point A by a feed-cloth, or by other suitable means; *b, b* are prongs, or they may be grates or other surfaces adapted to conduct the fibres through the bowl or trough *a* in effecting the washing thereof. These prongs *b* are affixed to bars, which are at their ends formed into necks, which pass into links of the chains *c, c*, by which those prongs may have progressive motion given to them with progressive motion given to the chains. Each end of each of the bars is also provided with a truck or bowl b^2, which passes between fixed guides, and are thereby correctly supported whilst traversing through the trough *a*. These bars are also provided with arms, with trucks or bowls, which pass into grooves formed between the fixed but curved bars a^2, a^2, by which the points of the prongs, in addition to their progressive motion imparted by the chains *c*, will have given to them, according to these improvements, an intermittent or forward and partial retrograde action. The chains *c, c* pass over drums or pulleys *d* and *e*, and are fixed respectively to shafts supported so as to be capable of revolving freely in suitable bearings. The axis of the drum *d* has motion given to it by a steam engine or other suitable power to give motion to the chains in the direction of the arrow. The fibre having been carried through the trough *a* from the point A to the point B by means of the prongs *b*, or by grates or other suitable surfaces operated, as described, it is thence raised out of the trough by means of a lifting drum *f* with arms capable of protruding for a time, and then of receding within the periphery of such drum during its revolution, such as is now well understood, or by other suitable means, and thence by the endless apron *g* to between the squeezing and expressing rollers *h, h*. The action of the instruments *b* causes the fibre under operation to be alternately drawn upon or pushed forward, and then relieved from such pressure in its passage through the wash liquid whilst a slight agitation will also be obtained, by which the wash liquid employed will be capable of acting more freely on all parts of the fibre, thereby facilitating cleansing without stringing or felting it.

SAFETY-LAMPS.

At the May meeting of the Manchester Geological Society, a discussion took place on the safety of the safety-lamp—a subject which has of late excited considerable attention amongst mining engineers. The subject was introduced by Mr. Binney, who said:—At a meeting held here on the 26th of February, 1861, a gentleman from London (Mr. Philip Holland) sent some seals for looking Davy-lamps. Mr. Holland was at that time not content with stating that his seal was a very capital plan for preventing the opening of lamps, but he also made a very strange assertion. He said, "There is no well-authenticated instance of explosion in a proper safety-lamp." That was the expression made use of. I then stated that this was a very serious matter, and the words I used were—"Now, I say there are many instances. The inventor of the Davy-lamp never said it was impossible to explode fire-damp by one of his lamps, because he knew it could be exploded, and he always cautioned people not to move the lamp against a current of air. We know that lamps are commonly moved against currents of air. He never expected there would be coal dust accumulated on the wire gauze, and then oil spilled upon such coal dust, and the lamp, without being cleaned, allowed to become full of flame. I have myself passed flame through standard gauze which has been covered with coal dust and oil. It is well known that lamps are frequently covered with coal dust, and nothing is more common than oil to be spilled on them. Yet here is a gentleman who sends forth to the world a lock with this dangerous advice—that a 'proper safety-lamp cannot be exploded.' I should like to ask the gentlemen present whether it is not possible to explode a safety-lamp?" Then there followed a long conversation, and many of the gentlemen present wanted to make it out that they did not know of any explosion when the lamp had been properly used. Mr. Livesey, for instance, said—"I know one case where a safety-lamp did fire, and several men were killed. The men finding the lamp get hot, laid it down; the others thinking that if left it might be burnt through, one man

went to fetch it, but it was so hot he let it fall, and the oil running out, it exploded." This was clearly a case of working with a hot lamp and an explosion. In some mines in former times, it certainly was frequently the custom to work with hot lamps. I have been in many mines where most of the lamps appeared to be getting hot, and the men did not take the slightest notice of them. This subject was discussed at a second meeting, and many gentlemen would not admit that such lamps could be exploded. I will, however, now repeat my opinion that the Davy-lamp can be exploded. The chairman did not commit himself so far as the rest, but it was the general opinion that the lamp could not be exploded; that lamps having coal dust and oil about them were not fit to be used; and that the lamps were not cared for as they should be. But in the North of England more decided opinions are now held. In the MECHANICS' MAGAZINE of April 17, there is a report of the North of England Institute of Mining Engineers upon the subject. One of the greatest authorities of the day in the coal trade (Mr. Nicholas Wood) gives an opinion which is entitled to much respect. The general impression in the North, I know, has been held for a long time that the flame would not pass through proper gauze, although the South Shields committee, in their most admirable report, published many years since, declared and proved the contrary to be the fact. What Mr. Wood here says is entitled to the greatest consideration, because it is contrary to what has been advanced before, and contrary to the ideas entertained by the audience whom he was addressing. He says—"His attention had been drawn to the subject by Mr. Greenwell, who had visited a colliery where they were in the habit of heating all their lamp gauzes red-hot previously to using them, to prevent their exploding the gas should they become red-hot in an inflammable mixture. The subject was one of very deep importance, and he (the President) had since made one or two experiments, by inserting new lamp gauzes into the interior of a short red-hot pipe, when explosions occurred from volatilization and subsequent inflammation of the oil attached to the gauze. He had tried, in a similar way, gauzes which had been thoroughly cleaned and brushed, also others after having been steeped in and thoroughly washed with a strong solution of alkali, and the same results followed. It seemed to him, therefore, probable that the oil was contained in the pores of the iron itself, introduced probably in the process of wire-drawing. He thought that the subject should be thoroughly investigated. Several explosions had occurred where safety lamps were in use, and which had never been satisfactorily explained. Careful experiments should be made further to prove the liability of a red-hot gauze to explode an inflammable mixture, and the circumstances under which this could occur; and if it be found that this liability really does exist, then remedial measures should at once be sought for and adopted. Some years ago he (the President) made several experiments on the safety-lamp, the results of which had appeared in their Transactions. The gas was on several occasions exploded by putting the lamp rapidly through it, after the gauze had attained a high temperature; and it was quite possible that the explosion was caused by the co-operation and subsequent ignition of the oil attached to the gauze. It would be well if these experiments were repeated to determine this. He thought the matter might very properly be left in the hands of the experimental committee, to arrange and carry out the necessary experiments." Now I think that after so great an authority as he saying that the gauze will admit of the flame passing through it, we should consider the subject carefully. He seems to think that some portion of the oil left in the wire in drawing it may have done it; but for myself I think in practice we could never have safety-lamps with much cleaner gauze than when they are new. They are far more dangerous when the oil has been spilled upon them after they have been covered with coal dust, and they have been handled by greasy hands. It is, in my estimation, a thing of great importance that a man like Mr. Wood should have his doubts as to the power of gauze in arresting the passage of flame, especially when we remember that hundreds of human lives depend upon it. It seems very strange to me that after nearly all the leading colliery proprietors in the North and other parts of England have been preaching the infallibility of wire gauze for thirty years, the foremost man of all now says such lamps are not safe, owing to a small quantity of oil left in the wire. Surely no time ought to be lost by those who trust the lives of their men to such lamps, in determining the truth of this statement.

Mr. Atkinson said it would appear that at a high temperature the gauze is not safe, but that it then sets fire to the gas on the outside. It is generally explained that the gas is not fired through in consequence of the meshes cooling the ignited gas to some extent, so that it will not flame outside. But may it not be that the gauze can get heated to such an extent that it actually fires the gas outside? I think some careful experiments should be made to ascertain this.

The President (Mr. Joseph Dickenson): I have met with many people in the course of my practice who have been afraid to use a new lamp in fire-damp, and I presume it must have arisen from some known explosion with a new lamp having been handed down by tradition. In South Staffordshire I have met with such cases; and so much afraid have some people been of using even an old safety-lamp that they would not use it in testing for fire-damp unless it had a double gauze. The having a double gauze, however, is I think, going to too great a refinement, and gives scarcely any light. I believe if the lamp is in thorough order, and has had no oil spilled upon it, it is safe under any ordinary circumstances. But at the same time, in some of the collieries of this country, I think we have had too much reliance placed upon the safety-lamp, more so, in fact, than is allowed in other countries. In Belgium, for instance, they actually prohibit the use of the Davy, Clanny, and other lamps which do not become extinguished in an explosive mixture, but which are used so freely in this country. That is a point, however, that is too little recognized, and which deserves more attention from our mining engineers than it has hitherto received.

Mr. Atkinson: It appears probable that at certain high temperatures the heated wire will explode fire-damp the same as flame.

Mr. Binney: All admit now that a hot wire is dangerous. But I was once in Manchester at a lecture, when the late Dr. Murray said that a Davy-lamp red-hot was safer than a cold one.

The President: That is both rashness and ignorance.

Mr. Binney: Yes, and a very terrible thing to tell colliers. The fact is, an ordinary Davy-lamp is not the thing to trust a common miner with in an atmoshere of fire-damp. Many ignorant men, because this is called a safety-lamp, think it is a talismanic, and safe under all circumstances, and away they go and work without any fear. Safety-lamp is a bad name under such circumstances; although the lamp is safe under ordinary conditions, and good usuage, it ought on no account to be continually used in an atmosphere of fire-damp. If it does not go out when the gas is at an explosive point, it ought to be put out or removed.

The President: In my own knowledge, only a few years ago, the safety-lamps were too frequently kept in a bad state—the pricker holes were too large, and the meshes were not the standard measure, and the parts not securely fitted together.

HOROIZONTAL ENGINES.

THERE is an unaccountable prejudice on the part of cotton spinners, corn millers, and brewers against horizontal steam-engines. This prejudice is derived from no experience, for engines of the kind in question have not been put upon anything like a sufficient trial in cotton mills, corn mills, or breweries. Nor is the objection founded in reason, for the balance of fact and argument is decidedly against beam engines. They are heavy and costly, require costly foundations, and occupy a great deal of room, and for all this they present no compensating advantages. In respect of weight, which is a tolerable index of cost, we may compare the non-condensing beam engine exhibited last year in the International Exhibition, by Messrs. Mirlees and Tait, with a horizontal engine of the same power, by the same makers, and intended for the same purpose, viz., driving a large sugar mill. The beam engine had a 22 in. cylinder and a 4 ft. 6 in. stroke, while the horizontal engine has a cylinder of the same diameter, with a stroke of 4 ft., making a somewhat greater number of revolutions with the same speed of piston and same total power. In the case of the beam engine, the bed plate weighed 7 tons 14 cwt., the six columns 5 tons 2 cwt., and the entablature 3 tons 5 cwt., making 16 tons 1 cwt. of framing. The bed plate of the horizontal engine weighs 4 tons 13 cwt., or but little more than one-fourth as much, while its actual stability is even then greater than that of the other arrangement of framing. The working beam of the beam engine weighed 2 tons, 5 cwt., the whole of which is saved in the horizontal engine. The cylinder of the beam engine being supported upon its end, and being, also, 6 in. longer, weighed 17 cwt. more than that of the horizontal, which, with covers, weighs 1 ton 13 cwt. The 20ft. fly-wheel of the horizontal engine weighs 9 tons; that of the beam engine, working slower, weighing 13½ tons, although we cannot charge any difference in this respect to the mere arrangement. The whole weight of the beam engine was 44 tons 9 cwt., while that of the horizontal engine is less than 20 tons. The excess of weight fairly attributable to the beam arrangement may be set down as at least 15 tons, and the proportionate cost may be pretty correctly inferred from this difference alone. The difference in the space occupied would be chiefly one of height, which, in this case, would not, perhaps, be of great consequence. With a still larger single cylinder engine, the beam would occupy from 2,000 to 4,000 cubic feet more space than the horizontal. The difference in foundations is also against the beam. The supposed advantages of the beam engine are that the cylinder and piston wear better, and that the parallel motion may be more conveniently applied, and thus economise power supposed to be wasted in friction on the guides of a horizontal engine. If there are any other advantages we are unaware of them. Examining the points of objection against the horizontal engine, we will first consider the cylinder. in point of fact the wear is little, if any, greater than in the beam engine, and the seat of wear, Instead of being at the bottom of the cylinder, as most of those who object to the arrangement conclude, in view of the weight of the piston, that it must be, is confined almost entirely to the upper part of the cylinder. The side of a cylinder next to the ports is always somewhat softer than elsewhere, owing to the greater mass of metal there; the lubrication is not so abundant at the top as at the bottom, and if the piston chance to blow a little steam, the abrasion thereby caused in a horizontal cylinder will necessarily be on the upper side. A cylinder of good metal is a long time, however, in wearing, whatever may be its position, unless, of course, it is under the care of a careless engine-man. It is not, however, every kind of pig iron that will serve for a cylinder. Those of Messrs. Penn's engines are of Madeley-wood No. 3 iron, and several of the locomotive makers have found an advantage in mixing a moderate quanity of wrought iron turnings with their pig metal, the result being an iron of great hardness, while, except in very large cylinders, the mixture will run very uniformly. The great cylinders, from 70 in. to 112 in. in diameter, employed for screw engines, wear very slowly indeed. In the horizontal engine the piston is much more convenient of access, and the packing is likely, therefore, to be looked after with more care. When, too, the cylinder does become worn it may be easily and quickly bored anew withou moving it from its bed, the portable boring ap paratus now largely adopted in railway wo shops being employed for that purpose. As

the parallel motion, that might be applied to a horizontal as well as to a beam engine, and indeed a Wiltshire agricultural engineer has actually adopted radius rods for the horizontal piston rods of portable engines. We do not, however, approve of "parallel" motions. In the first place, the motion thus given to the piston rod is not mathematically rectilinear, and cannot possibly be made so. But, more than this, with the least inaccuracy in original adjustment, or what is more likely, that resulting from slight wear, the radius rods throw a heavy strain upon the piston rod. With a horizontal engine, if the crank is made to turn in the proper direction, the pressure of the cross-head is always upward upon the guides; and as the upward pressure due to the angularity of the connecting rod is not great, relatively, where the rod is long, its weight and that of the cross-head tend materially to diminish the friction upon the guides. The mean inclination of the connecting rod to the guides should not, and need not, exceed 1 in 10 throughout the stroke, and the friction due to this pressure should not exceed, and probably would not be as much as, one-tenth of this pressure, or the one-hundredth part of the actual steam pressure on the piston. This is without making allowance for the weight of the connecting rod and cross-head, which might diminish the upward pressure due to angularity to an amount which would not probably involve a loss in friction of the guides amounting to one-half of 1 per cent. of the whole power of the engine. The whole friction, however, upon the guides of a horizontal engine can hardly be as much as that brought upon the crank pin and main bearings of a beam engine, in consequence of the worse than useless strain exerted upon them, at every stroke, by the momentum of a heavy and rapidly vibrating beam. A moment's reflection must show the loss of power in changing the motion, sixty times a minute, of a beam many feet in length, and weighing several tons. Indeed, the presence of the beam prevents the adoption of that speed of piston at which, all things taken into account, steam-engines work most economically. This remark applies, of course, to both beams and side levers, the latter typifying the worst form of beam engine. It would be useless to consider the working of a beam engine with 22 in. cylinders and 40 ft. stroke, at 60 revolutions per minute. The strain caused by putting the beam into motion and bringing it abruptly to rest 120 times in a minute would be very great. It is this impracticability of rapidly vibrating a heavy beam that has retained the old standard of 220 ft. to 250 ft. of piston per minute so long in use. Remove the beam, and the other parts of the engine are perfectly adapted to work at twice that speed, the heaviest engine in the navy working regularly and constantly at nearly 500 ft. per minute, while there is really no difficulty in working at an even higher speed. It is because of the necessity for slow speeds imposed by the beam, that such absurdly heavy masses of machinery are to be found in our cotton mills, flour mills, and breweries, and sometimes, we regret to say, in the factories of engineers who should know better. Other things being equal, and provided only that the supply of steam is sufficient, the same engine may exert 100 or 400 actual horse-power, according as it may be driven at, we will say, 20 or 80 revolutions per minute, and conversely, a quick working engine may give off the same power as a slow moving engine, and with a saving of from one-half to two-thirds of its weight. Quick speeds require, at most, only a moderate extension of the bearing surfaces, the work in any case being supposed to be carefully done.

That the preference for a heavy rather than a light job, has had something to do with the recommendation of the beam engine by so many constructing engineers, we may reasonably suppose. There are other engineers, however, not less well informed, nor less successful in the character of their work, who prefer horizontal engines, and are able to assign good and sufficient reasons for their preference. As more generally constructed, there is no doubt that horizontal land engines have not had the advantage of the same workmanship which has been expended upon beam engines; and this circumstance is unfortunate, as tending to the prejudice of the most mechanical arrangement of the steam-engine, instead of being interpreted, as it should be, to the disgrace of the workman. Excellence of material, design, proportions, and workmanship should be accorded alike to beam and horizontal engines, and it will then soon appear that the latter are the most deserving of preference.

Some of the principal Scotch paper-makers have adopted, or are about to adopt, horizontal single-cylinder engines, and we find that, with either one or two cylinders, horizontal engines are slowly working their way into flour mills. Even setting aside their great advantage in point of first cost, we are convinced that, with first-class workmanship, they will ultimately prove themselves superior in every respect to beam engines.—*The Engineer.*

PARADOXES IN THE VENTILATION OF MINES.

AT a recent meeting of the Northern Institute of Mining Engineers, a Paper on the above subject, by Messrs. Atkinson and Daglish, was read, of which the following is an abstract:—

When alterations are to be made in the ventilating currents of mines, practical knowledge is generally relied on to effect these; but it sometimes happens that the anticipated results are not realized, some of the currents proving stronger and others weaker than was expected, and others even failing entirely to establish themselves. In other instances, after accidents have occurred, or when extensive alterations are in progress in the workings or ventilating shafts, whereby some of the ordinary arrangements for ventilation have been materially affected, particular parts of mines have had their ventilation deranged in a manner and to an extent entirely unanticipated. All these cases may, with some degree of propriety, be termed "paradoxes." The Paper then proceeds to describe and explain a number of very remarkable instances where this action has been observable; these all requiring diagrams to be illustrated. The following practical deductions from the cases instanced are thus made at considerable length:—

1. The danger that may attend the use of two open routes from a return air-way, to any part of an up-cast shaft, at a considerable height above the level of the furnace, when the air in one of the routes, in ascending portions, is raised to a much higher temperature than that in the other.

2. The danger that may arise from the injudicious use and application of dumb drifts.

3. The probability of a reversal of the current in the upper seams of any colliery, when the up-cast shaft is contracted above by a cradle or scaffolding during the progress of repairs.

4. The danger attending intercommon ventilation between two adjoining collieries, having separate down-cast and up-cast shafts, arising from the extreme probability of variation, not only in quantity, but even in direction, of some of the splits of air—in cases of the ventilating powers of either of the collieries being considerably increased or diminished.

5. The necessity of insuring that a distinct pressure exists on all stoppings in a direction from where naked lights are used; and that in all cases a return from an in-take split should intervene between it and any separation stoppings of another split.

6. The danger attending the use of regulating doors instead of permanent regulators, placed so as to have as little passage as possible through them.

The necessity of using safety-lamps only in cases of falls in the air-ways, or other causes tending greatly to diminish the gross quantity of air circulating, especially in mines having extensive workings, either to the rise or dip of the shaft; as, in either case, reverse currents from the directions of the goaves would probably be established.

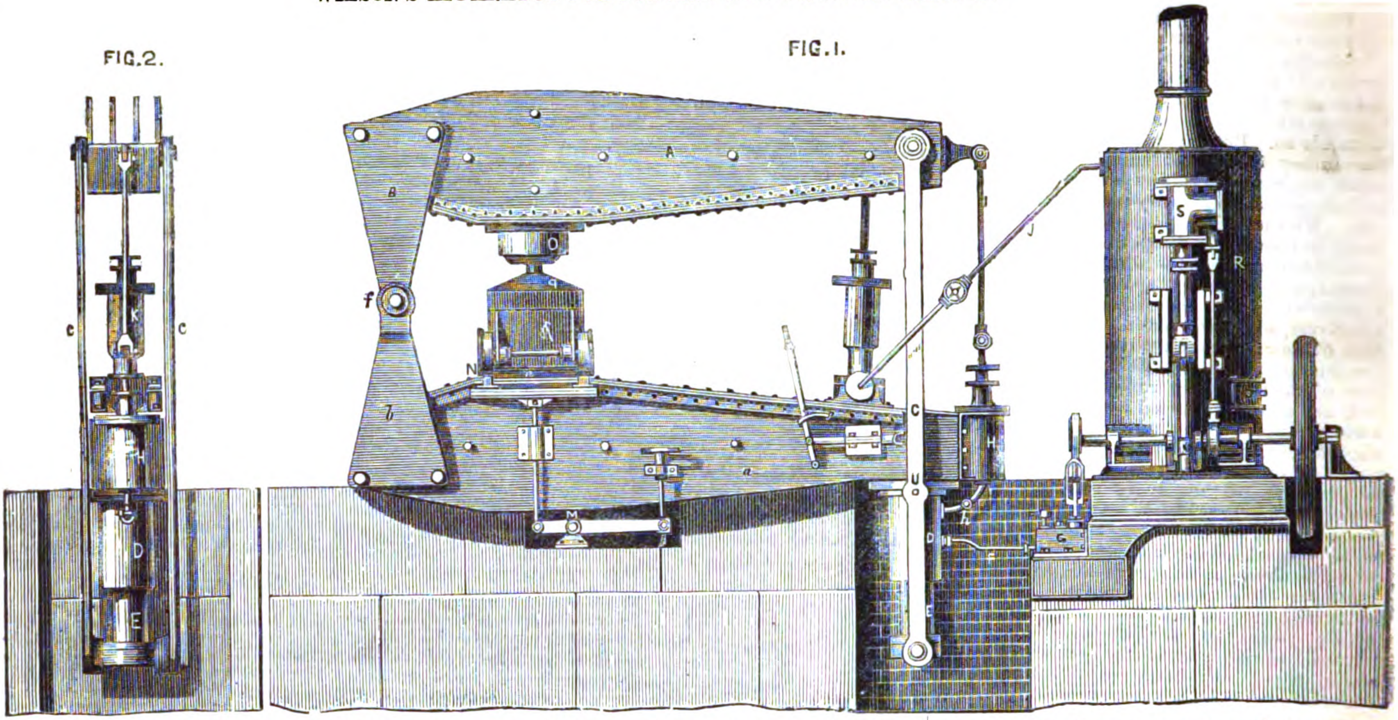
In conclusion, the title of "paradoxes" has not been employed to convey the idea that the ordinary laws of nature were either suspended, or in any way departed from, in producing the results given in these cases; but simply to imply that they were such as were not likely to be anticipated before they were observed, even by those experienced in the ventilation of mines. Cases like those described clearly demonstrate that the thorough and safe ventilation of a mine yielding fire-damp, requires for its accomplishment a great deal more than the mere obtaining and circulation of a large gross quantity of air. Indeed, after providing the power and means necessary, that great judgment, skill, and care should be exercised by the underground manager in making the arrangements for its proper and safe distribution. And, in addition to this, there is further required great and constant vigilance on the part of the subordinate agents; together with implicit obedience to discipline, and prudence on the part of each one of the work-people in the mine, in order to ensure even a moderate degree of safety, and of immunity from explosions of fire-damp. And with all these combined, explosions cannot be entirely prevented, for human prescience and forethought have their limit equally with human knowledge and skill, and all that we can hope for is the diminution of their frequency or the mitigation of their severity.

UNINFLAMMABLE STUFFS.

ON this important subject the French Academy of Sciences have received a report from MM. Payen, Velpeau, and Rayer, in which M. H. Chevalier's Paper sent in to the Academy on the 25th of January last, is discussed. From this report it appears that only three salts have hitherto been found that may be successfully applied to the purpose in question, viz., that of preventing ladies' dresses from catching fire. There are many other salts that would do the same, but not without spoiling the dye, or the gloss, or the texture of the stuff, &c. Of the three in question, the sulphate and phosphate of ammonia have the inconvenience of being decomposed by the heat of a smoothing-iron; but they are applicable in those manufactures where stuffs are stiffened by the action of hot air or cylinders heated by steam. They exercise no action upon either the thread or the colour of the stuff. The phosphate of ammonia may be mixed with half its weight of hydro-chlorate of ammonia. To obtain an efficacious solution, 20 per cent. of this mixture must be dissolved in water. A solution of 7 per cent. of sulphate of ammonia produces the same effect, and is therefore the most economical salt that the trade can employ. But in those cases in which the smoothing-iron cannot be dispensed with, as in linen, for instance, a solution of 20 per cent. of tungstate of soda should be preferred. To obtain the desired effect, all these solutions must be applied to the stuffs after they have been stiffened and dried, because starch is always used in a weaker solution than that required for these salts. Acid tungstates destroy the thread of cotton stuffs, like borax, alum, and other substances previously recommended. The tungstate of soda is prepared in Cornwall, where the tin mines yield a large quantity of wolfram. It costs from £12 to £18 per ton. The sulphate of ammonia costs about £14 per ton, and has hitherto been used for manure.

M. Sauvageon, a French investigator, has discovered that cotton cloth which has been exposed for a certain time to the vapour of burning sulphur, assumes such an amount of incombustibility, that although it will char and become brittle when held over the flame of a spirit lamp, it cannot be made to take fire, while under like conditions similar cloth, but unprepared in this way, is flamed immediately. If the alleged facts be borne out in practice, the problem is solved, for the simplest domestic means may be devised for subjecting, after being washed, all white clothing to the vapour of sulphur, which will tend to make it still whiter. Moreover, it may not prove necessary to repeat the exposure so often.

WILSON'S APPARATUS FOR FORGING AND PRESSING METALS.



WILSON'S APPARATUS FOR FORGING AND PRESSING METALS.

THE following improvements in forging machines have been just patented by Mr. E. B. Wilson, of 5, Parliament-street, Westminster.

The invention consists of a peculiar construction and arrangement of machinery or apparatus for forging and pressing metals and other substances, by the use of a powerful lever actuated by a screw, cam, steam, or hydraulic pressure, so as to produce either a constant or intermittent pressure upon the metal or other substance to be operated upon, such substances being forged or pressed into any desired form by the aid of suitable dies situate under the lever. One end of the lever is connected by a powerful link or strap to the end of a fixed beam which supports the die or matrix. The lever and beam are constructed either of cast or wrought iron or steel, and trussed or otherwise as may be found requisite according to the strength required. The free end of the lever is acted upon either by a screw or a cam, or by direct steam or hydraulic pressure, so as to give either a constant or intermittent pressure.

Fig. 1 represents a complete side elevation, and fig. 2 a front-end elevation of the apparatus.

A is the top or compressing beam, and *a* the corresponding bottom beam for receiving the die and taking up the pressure. These two beams are connected together at one end by powerful links or metal plates B, *b*, and work on the fulcrum or centre *f*. C, C are radial rods connected at their upper extremities to the front end of the top beam and at their lower ends to the opposite sides of the hydraulic ram E, working in the cylinder D. This cylinder is connected by a pipe F direct to the cistern of a hydraulic pump at G, which is worked by a steam engine S attached to the boiler R. Any other convenient arrangement of apparatus may however be employed in actuating the pump G. A water cylinder H (the piston rod of which is connected by a rod I to the lever or beam A) communicates by a pipe *h* with the cylinder of the hydraulic press, and holds sufficient water to fill that cylinder when the ram E is pressed down by the descent of the top lever A. By the use of this water cylinder or chamber H, the same quantity of water may be employed repeatedly without running to waste, since when the lever and ram E are raised the water in the cylinder D of the press will flow back again into the water cylinder H. Another advantage is, that the main cylinder D being filled by the water which is forced into it from the cylinder H as fast as the ram E descends, a saving of time is effected, inasmuch as a small quantity of water only (sufficient to give the final nip or pressure) is required to be pumped into the press through the separate pipe F. The lever is elevated by means of a steam cylinder K, the piston rod L of which is connected to the lever or beam A. J is the steam pipe which supplies the steam from the boiler R to the steam cylinder K, which cylinder is securely connected by a swivel joint to the beam *a*. P, *p* are the top and bottom dies; the top die P is connected by a ball-and-socket joint O to the beam A, and the bottom die is provided with running wheels as shown, whereby it can be readily brought under the beam A along rails or trams for that purpose. So soon as the die *p* is brought into its proper position over the beam *a* and under the top die P, the rail ends, shown at N, N, are permitted to descend a few inches so as to bring the bottom of the die *p* down upon a supporting block *n* on the surface of the beam *a*, when it is ready to receive the pressure of the upper beam and die P. The raising and lowering of the rails N may be effected in various ways, as by a screw spindle acting upon a lever M, as shown in fig 1. In order to maintain the lever or beam A elevated, the patentee employs a lever Q connected to a rod T, which is forked at one end, and works to-and-fro horizontally when the lever Q is moved. The forked end of this rod takes into a stud U fast in one or both the links C, and thus holds the beam elevated until released by the withdrawal of the rod T.

JORNS TIMEPIECES.

LETTERS patent have been granted to Heinrich Jörns, of Tessin, Mecklenburg, for improvements in clocks or timepieces.

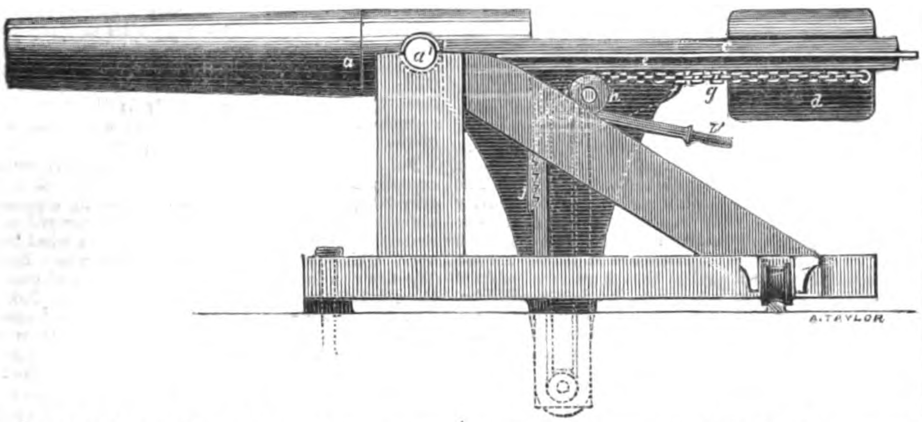
This invention is designed for obviating the necessity for winding up clocks or timepieces periodically, as at present practised. It is proposed to effect this through the agency of the variations in the temperature of the atmosphere, which is constantly taking place both inside and outside of dwelling-houses, and to employ the draught or current of air caused by such changes of temperature to set in motion certain mechanism to be connected to the ordinary mechanism of clocks, and by these means to produce a power sufficient to wind up a clock continuously, instead of having to wind it up by hand periodically, as at present practised. By this invention a great part of the weight at present necessary to keep the going parts of a clock in motion may be dispensed with; for example, a clock, which under ordinary circumstances would require four pounds to keep it going, may by this invention be kept going by the gravitating power of a weight of two ounces.

The following are examples of the means by which this invention may be carried into practical effect, that is to say:—The case containing the clock movements is formed with two vertical chambers, the foremost to contain the clock, and the back chamber for the passage of air by suitable inlet and outlet passages; the top or outlet passage aforesaid is provided with a flap valve, and the bottom or inlet passage is fitted with an ordinary revolving ventilator, upon the axis whereof a worm is formed, which gears into a worm-wheel for imparting rotary motion to wheel-work for winding up the going weight of the clock by means of an endless cord passing over a series of pulleys suitably placed. The action of the foregoing mechanism is as follows:—Suppose the clock to be only partly wound up, in this case the flap valve aforesaid will be open; suppose also that there is a hole made in that part of the wall against which the clock case is to be placed, the said hole will establish a communication by means of the aforesaid air chamber between the air both outside and inside of the room in which the clock is situated, and as the temperature of the air in the room varies from that outside of same, the effect will be to cause the air in the room to pass through the ventilator and outlet passage aforesaid, and thus impart motion to the winding mechanism connected therewith, and raise the going weight of the clock, and continue to do so until the weight is raised to its full extent, by which time a hook will have been brought into action and lifted a sliding piece of metal and weighted lever connected to the outlet air passage aforesaid, and by these means close the said air passage, by which the action of the ventilator will stop, and the winding up of the clock cease until the going weight aforesaid again descends by its gravity, by which the outlet passage will be again opened, when the winding mechanism will again come into action, and again raise the

BLAKELY'S IMPROVEMENTS IN BREECH-LOADING ORDNANCE.

FIG. 2.

FIG. 1.



going weight as before stated, and so on in succession, thus causing the said weight to be continually raised as it descends, the operation of winding being in effect self-acting, and constituting the feature of novelty in this invention.

BLAKELY'S IMPROVEMENTS IN BREECH-LOADING ORDNANCE.

THE following invention for improvements in cannon has been just patented by Captain Blakely.

The object of the first part of this invention is that the opening of the breech or separation of the breech-piece from the barrel may be effected by the act of firing, so that the firing of one charge will, in addition to throwing the projectile, open the parts and leave them in the position to receive a fresh charge. For this purpose the breech-piece projects into the barrel, and is retained in position by weight or elastic pressure proportionate to the power exerted by the pressure of the charge in firing. The firing causes the propulsion of the projectile, and at the same time the recoil of the breech-piece, thus opening the parts for the supply of a fresh charge. The breech-piece, enters the barrel to an extent sufficient to ensure its not leaving the breech end thereof until the shot or shell passes out of the muzzle. Holding means retain the parts when opened.

Fig. 1 shows a side view, and fig. 2 a plan, of a gun and parts connected with it according to this part of the invention; *a*, *a* being the body or barrel of the gun, supported by the trunnions a_1, a^1, in the carriage *b*. The dotted lines a^2, a^2, indicate the bore of the gun; *c* is the breech-piece, which is formed to enter the breech end of the gun, and, according to this part of the invention the breech-piece is affixed to or otherwise forms part of the block *d*, which has a groove formed in each side of it to receive the rails *e*, *e*, projecting from the end of the gun *a*, by which the block *d* with the breech-piece is supported, so as to be capable of sliding to and from the breech end of the gun, and in a line with the bore of it. The block *d* has a tendency to be drawn towards the barrel of the gun by means of a weight *f*, which, in combination with springs, are connected to the block *d* by chains *g*, *g* (or it may be by other suitable means); one end of each of these chains is connected to the weight *f*, and thence passing over a pulley *h* is connected at its other end to the block *d*, as shown. The weight *f* serves also as a platform or table for the support of the fresh charge and projectile previous to its being driven into the gun, and, by preference, a fresh charge is placed on this table, whilst the weight of that table is holding the breech-piece in the breech end of the gun. And when the parts are in the position indicated by the drawing, with the table raised, that table will hold the fresh charge correctly opposite the bore of the gun. The parts, as shown, are in the position they would assume after the firing of a charge, when the effect of the recoil has been to force out the breech-piece *c* with its block *d*, thereby overcoming the force exerted by the weight *f*. And in order that the block *d*, with its breech-piece *c*, may then remain in the position indicated until a fresh charge has been introduced, to the weight *f* a click or pawl *i*, and to the framing a rack *j*, are applied, by which when the weight *f* has been elevated it will be held up with the fresh charge thereon in position for loading. This charge must then be forced a short distance into the gun, and then by lifting the lever handle i^1 affixed to the click or pawl *i*, that click will be released ftom the rack *j*, when the weight *f* will descend again and draw the breech-piece to force the charge fully into the chamber of the gun; *k*, *k* are india-rubber or other elastic media adapted to act as buffers to resist shocks produced.

Secondly, the improvements relate to mounting ordnance to be fired through port-holes or embrasures, so that the axis of vertical motion is at or near the muzzle thereof, and at the portholes or embrasures. As in this case the weight of the gun and its carriage will not, as is ordinarily the case, be balanced near the axis of rotation, and consequently great power will be required to move them, it is preferred to apply the power required by means of hydrostatic pressure from a reservoir placed at a sufficient elevation, or by hydraulic apparatus.

ON THE WAVE OF HIGH WATER, WITH HINTS TOWARDS A NEW THEORY OF THE TIDES.

By THOMAS CARRICK, Esq.

THE author, starting from a new hypothesis on the relations of terrestrial matter to cosmical force, has arrived at the conclusion that the tidal motions of ocean surfaces are caused by a differential action of force centering on land areas. The nature of this hypothesis, and its relation to those motions, were briefly illustrated from the point of view of an assumed nebulous origin of the solar system. The author nevertheless declined to endorse the received "nebular hypothesis" as a genetic theory, and adopted its ideas and phraseology in his Paper solely from considerations of brevity in this incidental portion of his subject.

Assuming the existence of a diffused nebula, composed of ultimate atoms of matter each having a normal rotation on a fixed axis in a uniform direction, and with simple forces of attraction and repulsion arising thereout, then, from causes arising out of diverse molecular groupings of these atoms and their poles, the nebulous matter in condensing upon a centre might take up three successive states, constituting the normal types of the solid, liquid, and gaseous states of terrestrial science—the solid matter forming a spherical nucleus, everywhere covered with a concentric layer of fluid, and this overlaid with a gaseous envelope; these varying layers of matter being in stable equilibrium at the respective surfaces of contact. The force exerted upon such a sphere by another of like origin would therefore act by and through the intermediation of these three states—each successive stage of condensation, alike with a residual uncondensed nebulous matter of space, thus forming an essential link in the chain of gravitative action. But so soon as any portions of the solid nucleus emerge above the surface of fluid covering, into abnormal contact with the gaseous envelope, a differential action of enormous magnitude, centering upon these upheaved land areas would be at once originated, the first measure o which would be the cosmical value of the latent forces by which the fluid state of matter was constituted an essential intermediate link between the solid and gaseous states. In the view of the author, terrestrial matter in all its phases is now related to space, and to bodies in space, in a manner analagous to that which might have resulted from such a hypothetical origin. Not only does this matter exist in the three leading states of earth, water, and air, but each of the simpler forms of inorganic matter can, under given conditions, successively assume the solid, liquid, or gaseous state without undergoing any chemical change. This universal threefold relation of terrestrial matter points strongly towards the simple hypothesis, that the causal laws which now regulate these interchanges of state are the reflex of fundamental laws underlying the entire constitution of matter in the solar system.

Passing over the possible relation of the first land-upheaval to the early changes recorded by geology, and to the formation of heterogeneous solids, liquids, and gases, the differential force arising therefrom would be the initiating cause in the formation of the envelope of comminuted water or vapour which now encircles the whole globe. This vapour-ocean constitutes an intermediate state of matter in unstable equilibrium with other states at all surfaces of contact. By interactions arising thereout, the simple static conditions of force existing prior to land-upheaval are now, in the view of the author, partly replaced by more complex phases of force; and thus light, heat, electricity, and magnetism, which are expressions of these complex phases, which have their root in local reactions between unstable states of terrestrial matter at surfaces of abnormal contact when under the tension ot cosmical force—just as these "imponderable elements" are evoked in the voltaic battery by surface reactions of dissimilar solids and liquids in presence of atmospheric tension. In short, the ceaseless molecular changes and local motions of terrestrial matter would, on this hypothesis, be mainly referred to the differential action arising out of land-upheaval.

Recurring to the "wave of high water" which formed the special subject of the Paper, another phase of the present residual of that differential action would give rise to the tidal motions of ocean surfaces, the perturbative action centering on land areas, and attaining a maximum value on the shores of those areas. By discussing the hours of high water at full and change for the principal places of the globe, given in the Admiralty Tide Tables for 1863 (the data being r

reduced to Greenwich mean time), the author arrived at the following law of the progression of the wave of high water:—

In all areas in the northern hemisphere the wave of high water tends to revolve round the coast in the direction of the hands of a watch, and in like areas in the southern hemisphere against the hands of a watch.

Theoretically, this law should hold good in proportion as land areas approximate to the circular form, with wide uninterrupted ocean spaces all round. In a perfectly circular area of this kind, the differential action would have points of maximum and minimum effect on opposite shores at every instant, these together forming a nodal line, both ends of which would move simultaneously round the coast as the moon passed across the heavens, the wave of high water being everywhere the instantaneous expression of the differential force at its nodal point of maximum action.

By enclosing the continents and land areas which approach nearest to the prescribed conditions within one or more circles intersecting the salient parts of the coast, the author showed that whenever any systematic progression of the hour of high water could be distinctly traced, that progression is almost invariably in the required direction. Owing, however, to the irregular shape of all existing land areas, to the impossibility of including some of these in a single circle approximating to the coast line, and to the way in which some large areas are massed upon others with little or no intervening ocean spaces, many instances of anomalous results are found; and yet, when rightly considered in relation to disturbing causes, even these tend indirectly to confirm the method of grouping the data of tidal hours in relation to land areas as causal centres.—*Proceedings of the Manchester Literary and Philosophical Society, Physical and Mathematical Section*, April 30, 1863.

ON THE STATE OF CARBON IN CAST IRON.

The following Paper, by William Crossley, F.C.S., has appeared in the *Chemical News*:—

I have long been of opinion that anything throwing light upon the chemical constitution of cast or wrought iron and steel is of great importance, and I submit the following considerations, which are partially supported by experiment, as tending in this direction.

In analysis of cast iron the carbon is generally shown in two states—viz., combined and uncombined; combined as a fusible carbide, uncombined as graphite disseminated throughout the mass of the iron; and, according as the graphite or the carbide predominates, we have grey or white iron. The white is said to owe its peculiar properties to containing but little graphite and much carbide. The grey, on the contrary, contains but little carbide and much graphite, or free carbon.

I don't know why these views should be held, never having seen any reason given. They are the views, however, generally held, as may be easily shown.

In the *Chemical News* for Saturday, January 31, 1863, in a Paper on the Chemical Constitution of Iron, &c., by General Sobrero, of Turin, the following passage will be found:—

". . . The cast iron is agitated until the moment it solidifies; for this reason, carbon cannot crystallize separately, but remains in combination, hence white iron results."

F. A. Abel, Esq., in a lecture at the Royal Institution, April 27, 1860, says:—

"In looking at these specimens of cast iron, you will be at no loss to discover a very considerable difference in the appearance of most of them—a difference which is borne out by fully as great a variation in their physical properties and chemical composition. Here is a very dark specimen, with glistening fracture, containing a considerable portion of carbon in a peculiar condition—in the graphitic form, as it is called."

Miller, in his "Inorganic Chemistry," p. 879, says:—

"In many varieties of cast iron the carbon exists in two distinct forms—one portion being chemically combined with the metal, the other mechanically diffused through it as grrphite—the scales of which may be distinctly seen with a magnifying lens, when the surface of a newly-fractured bar is examined; these scales remain unacted upon when the metal is dissolved in dilute acid."

I have frequently had occasion to examine samples of grey iron with a lens, and never yet have I seen the scales here referred to; and I believe if grey iron be carefully examined, it will be found to be made up, not of iron and graphite, but of crystals aggregated together, and containing carbon and iron chemically combined. When iron is acted upon by dilute acids, as shown by Calvert, the carbonaceous matter left possesses the same form, and occupies the same bulk, and, in fact, has the same appearance in every respect as the iron from which it has been obtained.

But, for the sake of argument, we will suppose that in grey iron the carbon is really as graphite; and here at once a difficulty meets us. How is it that grey iron is more fluid than white iron? In grey iron we have almost a pure iron (which is very difficult to make fluid at all) merely mixed with carbon. In white iron, on the contrary, the carbon is chemically combined, and we all know how much more fluid melted carbide of iron is than iron free from carbon. How is it, too, that the graphite does not separate when the iron is in the fluid state? The graphite itself is infusible, and its specific gravity much lower than the iron in which it floats, one would think that it would separate from the iron and rise to the surface. There are those who answer these questions by saying that iron is capable of dissolving graphite when it melts, and again liberating this graphite when it cools, while others say that a carbide of iron is formed when the iron melts; this carbide is again decomposed on cooling.

I think I can prove, that neither of these explanations can be correct, or, indeed, any other where it is assumed that the carbon exists in the two states, combined and uncombined. First, let us see how far the theory that the graphite, when the iron melts, is converted into a fluid carbide, holds good. Before doing this, however, let me draw attention to the fact, that iron made from the same stone, and under nearly the same circumstances, whether white or grey, contains about the same total percentage of carbon. For instance, the carbon determined by combustion in three samples of grey and three of white iron gave the following results:—

	Grey.	Average.	White.	Average.
Carbon	3·94	3·91 per cent.	= 3·86	= 3·87 per cent.
„	3·92		= 3·85	
„	3·88		= 3·95	
Difference	. . .		·04 per cent.	

We will assume, now, that these irons are melted. The white is already a carbide; the grey is converted into one by melting. Here we have, then, two irons in the fluid state both containing the same quantity of carbon, yet one more fluid than the other. Let them cool and solidify. How is it that one separates graphite and the other does not? Not only this, but we actually know beforehand which of the two will liberate the graphite, or, in other words, be the greyest. If this theory be correct, surely graphite ought not to be separated in the one case and not in the other.

2. The theory of solution. This, I think, is even more untenable than the one already referred to. Faraday has shown that iron is capable of combining with 6 per cent. of carbon. Very few commercial irons contain more than 4 per cent., and if a portion of this be uncombined, I cannot understand the iron dissolving without at the same time combining with it, much in the same way that a solution of chloride of iron, and containing an excess of iron, will dissolve more iron by uniting with this iron to form more chloride.

There is an experiment mentioned by Carey, I believe repeated by Wylde, and confirmed by myself, where a little sulphide of iron is added to melted grey cast iron; the iron immediately changed to white, with the liberation of graphite, which rises at once to the surface of the iron; and I hold that if this graphite had been merely mechanically mixed, and yet unable to separate, separation would not have occurred on the addition of sulphide, for the quantity requisite is not sufficient to produce any material change in the physical properties of the iron while in a fluid state.

We will now look at these questions, assuming, first, that there are two carbides of iron, and that cast iron is a mixture of the two with an excess, perhaps, of metallic iron, or of iron alloyed with silicium, calcium, manganese, &c. The one carbide is grey and soft, the other white and hard, and for reasons explained hereafter, we must suppose the grey to be a higher carbide than the white. We can now easily account for the non-separation of the graphite when grey iron is melted, the grey appearance being due, not to this substance, but to a fusible compound of carbon and iron. But it may be said that graphite does separate when the grey iron is melted. Admitted; but how small a percentage of the total carbon present separates in this manner; and this quantity can be accounted for as resulting from the decomposition of the grey carbide; in fact, this brings us to one of the principal properties of grey iron—viz., its instability. Like some of the complex compounds known in organic chemistry, very slight changes are sufficient to effect its decomposition. This is shown by the liberation of carbon when a little sulphide of iron is added to it while in the melted state, also by its non-production, excepting when the furnace is in the very best working condition; very sudden changes of temperature, too, may effect its decomposition. In many of their properties the grey and white carbides of iron may be compared with the two compounds of carbon and hydrogen C_2H^6 and C_4H_4. How much more stable is the lower carbide than the other; and how readily is the latter decomposed with liberation of carbon, and formation of the less highly carbonized compound.

For the purpose of testing some of these views by experiment, I broke four pieces from a pig of very grey iron, and putting three of these in separate plumbago crucibles, each crucible was covered and coated with fire-clay, and then put into a wind furnace, which was gradually urged to a white heat. The fire was then allowed to burn out, and one of the crucibles removed, which was labelled No. 1. The fire was again lighted and urged, and again allowed to cool, and another crucible was then removed, and labelled No. 2. The third was again treated in a similar manner, and then labelled No. 3.

My object in melting in carbon crucibles was to prevent access of air to the melted iron; if any air did succeed in passing through the crucible it would be deoxidized by the carbon of the crucibles.

The button of iron found in No. 1 crucible was coated on the outside with "keech," or kish, as the graphite is generally called. When the button was split, the fracture showed it to be "No." 3 iron.

The button of iron from No. 2 crucible had less graphite on the outside, and, judging from the fracture, it might be called "No." 4 iron.

The button from No. 3 crucible was "mottled," or "No." 5 iron; it was quite free from graphite on the outside.

Thus, by melting "No." 1 once, "No." 3 iron was formed; melting a second time, "No." 4 iron; and a third time, "No." 5 iron.

I explained these changes by supposing that in the first melting a small quantity of the grey iron had been decomposed and a little graphite liberated; in the second melting more graphite separated, but the graphite liberated from the first melting had again united to form the white carbide; in the third melting all the graphite which had previously separated again combined, and "mottled" iron resulted.

I afterwards determined the carbon in the buttons of iron, and the results obtained appear to confirm the above views.

They were as follows:—

Iron before melting, carbon	= 3·93	per cent.
1st melting	= 3·86	„
2nd „	= 3·90	„
3rd „	= 3·95	„

The low results obtained in No. 1 is accounted for by the graphite liberated in melting. In No. 3, the graphite had again combined, hence this discrepancy is not seen.

Another fact which seems to support the view that the carbon in grey iron is chemically combined is the loss of carbon in the form of volatile carbides of hydrogen; when iron is acted upon by acids, no matter how grey the iron may be, or how large the crystals, there is always some loss in this manner, besides a liquid oily substance formed, which floats on the surface of the acid.

In conclusion, many writers mention the fact, although I have never tried the experiment myself, that by exposing a bar of wrought iron to a high temperature in a current of coal gas, it is impossible to convert it into grey iron. Now, if grey iron contains large flakes of graphite disseminated throughout its mass, I would ask how these flakes can possibly enter the pores of the bar and get into its interior in an experiment of this kind? I can understand the outer coating of iron acting as carrier of combined carbon in the inner portion, and by this means the bar of iron increasing in size and assuming a crystalline form; but I cannot understand a flake of graphite being first formed on the outside, and then forcing its way into the interior, changing the properties and form of the bar.

WORKING EXPENSES OF FIRE-ENGINES IN AMERICA.

THE Amoskeag Manufactory Company publish the following statement which is sufficiently interesting:—

In regard to the cost of running a steam fire-engine many people have very wrong impressions, being led, by the reports of the cost of maintaining them in some large cities when they were first put into service, to suppose that the expense must be very great in all cases. In these cities a regular "fire-brigade" is employed, and the extinguishment of fires is a daily business, and the number of men necessary to work an engine are constantly employed and paid. But even here, as shown by the reports, the use of steam-engines has reduced the the running expenses of the fire department. But in cities of 25,000 inhabitants, more or less, where fires occur perhaps not oftener than once or twice in a month, the expense of maintaining a steam fire-engine is very much reduced; in fact, a steamer in such a city can be run at a less expense per annum than the usual cost of main- taining a hand-engine.

In the city of Manchester, N.H., the fire department consists of three steam fire-engines. We append below the expense of running these engines one year, taken from the city report, and the expense of running a hand-engine for the same period. The cost of repairs is found by experience to be no greater on the steam fire-engines than on hand-engines. The first steam-engine, which has been three years in service, has not required a cent. to be expended upon it as yet.

A steam fire-engine company is composed of fourteen men, all told, one of whom, acting as a driver and steward, is constantly employed, remaining at the engine-house with a pair of horses always ready to run out with the engine in case of an alarm of fire. The other members of the company have other employments, and turn out only on an alarm of fire.

STEAM FIRE-ENGINES.

		dols.
"Amoskeag,"	Expenditures	864 32
"Fire King,"	"	855 78
"E. W. Harrington,"	"	496 09

The above expense includes pay of members, team expenses, cost of gas, wood, coal, and all necessities incident to service.

The "E. W. Harrington" is a second-class engine, stationed in the outskirts of the city, and was run cheaper from the fact that no horses were kept for it by the city.

A first-class hand-engine company is allowed to number, all told, fifty men, and the members of the company are paid as follows:—

FIRST CLASS HAND-ENGINE COMPANY.

	dols.
1 foreman	35 00
1 assistant forman	28 00
1 clerk	28 00
1 steward	68 00
46 men, at 18 dols. each	828 00
50 men. Total	987 00

By this it will be seen that in a city like Manchester, with 20,000 to 25,000 inhabitants, a first-class steam fire-engine can be run at an expense not to exceed that of a first-class hand-engine, while in service it will do at least *four times* the work.

In the city of Boston, the comparative cost of running the two kinds of engines is as follows—viz:—

STEAM FIRE-ENGINE.

	dols.
1 engineer	720 00
1 fireman	600 00
1 driver	600 00
1 foreman of hose	150 00
3 hosemen, at 125 dols. each	375 00
7 men	2445 00
Keeping of 2 horses	315 00
Total	2760 00

HAND-ENGINE.

	dols.
1 foreman	150 00
1 assistant foreman	175 00
1 clerk	125 00
1 steward	125 00
3 leading horsemen, at 125 dols. each	375 00
33 men, at 100 dols. each	3300 00
40 men.	4200 00

Here the engineer, fireman, and driver are constantly employed, the horsemen have other employment in the neighbourhood, but all the company sleep in the engine-house.

When a steam fire-engine is drawn to a fire by the men composing the company, the running expenses are of course no greater than they would be if the same company used a hand-engine.

ARE SCRAPED SURFACES INDISPENSABLE?

IN stating this question as broadly as we have done, we disclaim at the outset any intention of dispensing utterly with scraped surfaces, or of erasing from the vocabulary of mechanical technicalities this detail of the workshop. The doubt has arisen in our mind whether much of the time and elaboration expended on scraping iron surfaces might not, without injury to the work itself, be omitted. The value of a positively correct face on a valve seat or on the V-shaped ribs of a slide lathe or planer, is undoubtedly great when it is well done, but when poorly executed the utility of it is, to say the least, questionable. We make the unqualified assertion that not one man in twenty is competent to finish a truly scraped surface. Scraping iron down to a perfect face is an art by itself, and comparatively little attention, so to speak, has been given to the subject in this country. The common method in use is to take an old file of any kind (except round or square), flatten its end out like a chisel, grind it up square on the stone, and then "grub" away on the iron wherever the workman sees fit. The chances are that previous experience has not fitted the operative for this branch of his business, and he mistakes a shade on the iron for a bearing and makes a depression still deeper by misapprehending the "situation." Of course the fallacy of attempting to make a true face in this way is manifest to every one familiar with the subject. It would have been far better to have saved time wasted in such attempts and trust to good planing and attendance in future to rectify inaccuracies.

The better way to make a scraper is to form it like a Venetian stiletto, or, more familiarly, after the model of the section of a beech nut; that is, to have the blade triangular in section, and approaching concavity. With such an instrument, properly tempered, ground, and sharpened, the finest work can be produced. A flat-faced scraper is an abomination, and only fit to dig holes or to rough out the work for the triangular scraper; it is apt to make "chatters" in the surface, and when these occur we may bid a long farewell to any fine work without filing them out—a very pretty task to undertake after something like accuracy has been attained. Most scraped surfaces are nothing but a combination of scratches, shining blotches, and untruth; and while they are a waste of time to execute, they add nothing to the mechanical value of the work. We may fairly question whether valve-seats up to 180 sq. in. of area, say 15 in. by 12 in., are benefited by scraping. In some locomotive-shops in this country it is the practice to plane the valve-seat so that the tool-marks on it run in one direction, and place the valve so that similar marks cross the seat at right angles, and to set the valves running in this way without further adjustment. The results observed are that in a few days the valve has made a seat for itself that is far more durable than if it had been badly scraped. We do not go so far as some persons and assert that a scraped valve-seat is a positive injury, insomuch that the pores of the iron are filled with an impalpable dust that works out to the detriment of the engine in future; this theory is very finely drawn, although it may be partly sustained by facts. A finely-finished mirror-like surface on a valve-seat or lathe shears is indubitably of great value, and we must, in common justice, give credit to English workmen for great skill in this particular; in general they far excel our own workmen.

There is no reason whatever to interfere with the execution of a finely-elaborated scraped surface in our own shops; but our observation convinces us that time spent in doing such work as we have seen, might be better employed in some other way.—*Scientific American.*

PHOTELECTRIC ENGRAVING.

ONE of the most remarkable, if not important results of modern science, is the power of producing an engraved copper-plate without the direct use of instruments. A plate, in fact, which is really an admirable photograph, capable of producing thousands of copies, which resemble ordinary sun pictures in nothing save minute beauty of detail.

It is needless to say that the attempt to cause the image cast by a lens within a camera to register itself on metal or wood in such a manner that impressions in ink might subsequently be obtained, is by no means new; and judging from a specimen engraving taken by Dallas's process which has been laid before us, this desirable end has been obtained at last with considerable success.

Mr. Dallas has addressed a letter to the Society of Arts on the subject:—

"In consequence of the very questionable protection afforded by the patent laws, I deem it advisable at present not to publish the details of my process.

"I can produce, in a period varying from one to three weeks, an engraved plate from a photograph. In this plate, that which constitutes the essence of the photograph and the despair of hand labour —*fac-simile* even to minute and almost microscopic detail—shall be present. To attain this result, all that I require is a good reversed negative (easily produced by reversing the glass), and a positive print merely fixed with "hypo," not toned.

"The methods which have hitherto given most promise are the bitumen process, photoglyphy, and photogalvanography. The other processes of photolithography and photozincography, from their very nature, cannot rival the richness of plate printing. The bitumen process and photoglyphy are essentially etching processes, and involve much hand labour and consequent loss of fidelity. Photoglyphy is the least satisfactory of the two, as the etching ground employed is of a very delicate nature, and the photographic chemical, bichromate of potash, has the unfortunate quality of destroying detail, the longer it is submitted to actinic influence.

"The most important step in advance was photogalvanography. This process came into my hands when in a most crude and impracticable condition, and after it had been given up as useless by others. By much patient labour I succeeded in making it practical, and the process has ever since been worked with the improvements which I effected. I was not permitted to reap the fruit of my labours, and after a considerable sum had been expended, by my then partners, to develop the process in a direction to which it was wholly unsuitable, the process has been almost abandoned.

"Photogalvanography, like photoglyphy, depends on the peculiar action of bichromate of potash, in combination with gelatine. In this lies its weakness. It loses detail—the more so as it requires a very long exposure, sometimes upwards of six hours, and then without any certainty that the right exposure has been attained. There are constantly numerous failures from this one cause alone.

"I experimented long with this process, and found that the result was due to chromic acid. In other words, that with a composition merely of chromic acid and gelatine, a raised image with granulation could be produced. From this raised image the electrotype plate was subsequently made. Independently of the loss of detail, and the uncertainty in the exposure—both defects inherent in the process—the granulation was of a peculiar zigzag and wiry character, which was of great value in the vigorous parts of the picture, but became broken or unconnected in the half-tones and fine details. This led to a pretty free employment of the graver and roulette, just in the very parts which made hand labour expensive. The process, indeed, was never capable of the high flight which was attempted, and, as I predicted, it broke down. Where expense was no object, the graver was a great assistance, but it lessened the value of the *fac-simile*.

"In photoglyphy and photogalvanography, the results are obtained from a positive impression.

"It was after experimenting some time with photogalvanography that it occurred to me to strike out in a different direction. Any one acquainted with engraving is aware that acquatint and "chalk," or stippling, produce fine grain, half tones, and detail. The problem I set myself was how to imitate this combination. The acquatinter employs common resin dissolved in spirits of wine. This poured over his plate evaporates, and leaves numerous globules of resin attached to the surface. The size of these globules depends on the proportion of resin to spirit. When the acid is put on the plate the resin acts as a resist, and a tint is produced in the intermediate parts. If the plate were now electrotyped before the removal of the resin, and a print taken from the electrotype, the resin parts would give a kind of stipple or "chalk" marks, interspersed with tint. It is something similar to this which I have succeeded in imitating, with peculiarities *sui generis*, by photography and the electrotype. I can also, as it were, modify the size of the

dots, obtaining them so fine as to carry almost microscopic detail; but if too fine there will be deficient depth in the dark. In this as in all things there is the happy medium, and this I believe I have secured. I commence with the negative. This should be reversed. From the negative a positive proof is taken; this I prefer not toned but merely fixed in the sepia colour by the "hypo." I cover the negative, which must be varnished with a material from which I obtain the latent positive. This latent positive I turn by a simple process into a suitable negative, and it is with this negative that I subsequently manipulate. I can time the exposure to a nicety, a few seconds over or under making an inappreciable difference. The excess or deficiency must not, however, extend to minutes. If necessary I can electrotype direct upon my material; but as this might lead to the discovery of part of my process, I prefer to make a different kind of matrix."

MANCHESTER STEAM BOILER ASSOCIATION.

At the last ordinary Monthly Meeting of the Executive Committee of this Association, held at the Offices, 41, Corporation-street, Manchester, on Tuesday, July, 28th, 1863, William Fairbairn, Esq., C.E., F.R.S., in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month there have been examined 324 engines and 450 boilers. Of the latter, 17 have been examined specially, 11 internally, 55 thoroughly, and 367 externally; in addition to which 3 of these boilers have been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture, 8 (2 dangerous); corrosion, 16; safety-valves out of order, 9 (3 dangerous); water gauges ditto, 2; pressure gauges ditto, 8; blow-out apparatus ditto, 37; fusible plugs ditto, 2; furnaces out of shape, 4; over pressure, 1 (dangerous); deficiency of water, 1 (dangerous); blistered plates, 3; total, 110 (6 dangerous). Boilers without glass water gauges, 2; without blow-out taps, 38; without back pressure valves, 41.

"It is gratifying to find that the number of 'thorough' examinations of boilers, though not high during the past month, is steadily increasing. During the month ending June 26th last, as many as 104 were made, in addition to 12 'internal,' and 10 'special'—making 126, independently of the ordinary 'external' examinations. This number is a greater one than has been reached in any previous month.

EXPLOSIONS.

"One explosion has occurred during the last month, of a very fatal character, to an ordinary mill boiler of the two-flued 'Lancashire' class, by which 10 persons were killed and four others injured. This boiler was not under the inspection of this Association.

"The dimensions were as follows—length 30 ft., diameter of the shell nearly 7 ft. 6 in., and that of the furnace tubes—which were parallel throughout, and not strengthened by any hoops or flanges—2 ft. 8 in.; the thickness of the plates in the shell and tubes, seven-sixteenths, in the flat end plates half an inch, each of them being strengthened with three gusset stays, secured with double angle irons.

"The longitudinal seams in the shell were not laid in line, but disposed so as to break joint. The age of the boiler was about two years. It had not been tested by hydraulic pressure.

"The boiler had been fitted with a single lever safety-valve, the valve being enclosed in a box bonnetted over, from which the waste steam escaped through a discharge pipe, carried through the wall of the boiler-house. It had also been fitted with a glass water gauge—a feed-check and back-pressure valve combined, fixed to the front end plate, a little below water level—a blow out or mud tap, and a steam pressure gauge, of the dial class; but the boiler had no tap for fixing an indicator, so as to check the accuracy of the gauge, and ascertain the actual working pressure with the steam up.

"The boiler was rent into so many fragments by the explosion, that it was completely destroyed, while considerable damage was also done to the surrounding property. Both the furnace tubes were torn away from the end plates, as well as separated into two pieces, dividing at one of the transverse seams at the middle of their length. Three of these lengths, weighing upwards of a ton each, were blown over a row of cottages, one alighting on the first floor of a dwelling beyond, having broken through the roof in its fall, the other two lengths falling at intermediate distances between these two rows of buildings; while the fourth fell on a cottage, carrying in the roof. The safety-valve weight, which was a ball of about 8 in. diameter, was shot upwards, and on its fall, broke through a roof of a third cottage. The shell of the boiler had been torn up into so many small pieces that it was difficult to trace the course of the rents, and to determine where they had first commenced; but it may be remarked, that one of them ran through the manhole, which was not strengthened as it should have been by a substantial mouth-piece. These fragments of the shell lay scattered near the original seat of the boiler, while some were buried under the ruins. The end wall of the mill was blown down, and the various floors laid open, while the engine was completely buried in the *debris*. The chimney was gashed by a large rent, running up it for half its height, and stood tottering over the old seat of the boiler, so that approach was dangerous; while the ground surrounding was covered with bricks, and the ruins of the injured buildings. But it is difficult to convey an adequate idea of the ruin that had been produced.

"The cause of the explosion has twice been investigated before a coroner's jury, conducted in each instance by a different coroner on account of the localities in which the deaths occurred. Scientific evidence was given in each case. At the first trial, one scientific witness gave it as his opinion that there were no traces of there having been any deficiency of water, but that the safety-valve had been deranged and inoperative; while at the second trial, another scientific witness thought that the safety-valve had worked quite 'glibly,' and that shortness of water had caused the explosion. A verdict of accidental death was brought in in each instance.

"With regard to the explosion having arisen from shortness of water, it was given in evidence at the inquest that the gauge-glass was blown through, and plenty of water observed shortly before the explosion happened: the correctness of which was borne out by subsequent examination, since the flues were found to be coated with incrustation which overheating, had it occurred, would have disturbed; while, in addition, the furnace-crowns could not have retained their shape as they did, had the water been low.

"As to the explosion being due to excessive pressure consequent upon the defect of the safety-valve, it is true that the spindle of the valve was bent, but it is a matter of opinion whether this did not become so subsequently to the explosion, and was its consequence rather than its cause. At the time of making my own examination, which was done immediately on the explosion being reported, there was no opportunity of seeing the safety-valve, since it was in the hands of the jury who were then engaged on the inquest—but I am informed, on good authority, that the injury was such as could not have occurred to the valve in regular work, while it was known to have been previously in good order.

"But, apart from the condition of the safety-valve, there are other considerations affecting the view that the explosion was due to excessive pressure alone. There was no evidence to prove that the pressure exceeded 60 lb. per square inch, and neither that nor twice the amount would have rent the shell had the material and workmanship been good; while from the fact that the flue-tubes were not collapsed, and the shell was rent into fragments—although the latter should have resisted twice the strain of the former—it is clear that the explosion did not result from simple over pressure.

"It cannot be doubted that the plates were of very bad quality, one of them in the shell, situated at the top of the external flue, had fractured through the solid when the boiler was at work a few months since, while it is reported that one of the scientific witnesses who gave evidence at the inquest stated—that merely with the blow of a brick he had broken off a piece of plate about 15 or 16 sq. in. in area, and seven-sixteenths in thickness. The cast-iron nature of the plates rendered them less adapted to withstand the tensile strain of the shell than the compressive one of the furnace tubes which therefore accounts for the shell having been broke into pieces, while the furnace tubes were uninjured, except by the effects of the explosion itself.

"Such is the simple cause of this explosion. The evidence given at the inquest, as well as the examination of the furnace-crowns, forbids the conclusion that the explosion was caused by a deficiency of water; while, further, the fact that the shell, which should have been stronger than the tubes, rent into a number of small pieces while the tubes did not collapse, shows that the explosion was not due to excessive pressure, but to the defective quality of the plates of which the boiler, on examination, was found to have been made."

"In conclusion, the attention of our members may be specially called to the following points:—

"The contradictory nature of the evidence too frequently admitted at coroners' inquests as to the cause of boiler explosions, of which the case above is an illustration.

"The short-sighted economy of purchasing low-priced boilers, erroneously termed 'cheap,' which leaves the maker no alternative but to use plates of inferior quality, a practice not only detrimental to the interests of the steam user, but also unfair to the honest boiler-maker.

"The importance of having all boilers thoroughly tested with dydraulic pressure; this had never been done with the boiler under consideration; had the test been applied, there can be little doubt that the inferior quality of the plates would have been detected, and the explosion prevented."

L. E. FLETCHER, Chief Engineer.

TO CORRESPONDENTS.

G. G.—We will try to let you have all the particulars you request next week.

W. P. (Manchester.)—Willow or alder seems to be more suitable for millstone bushes than any of the harder woods; but why not employ the regular hemp packed stuffing-box, which you will find in every respect superior?

BOILER (Newcastle).—The angle iron rings should be put on at distances of every 10 ft., or thereabouts, on the internal flue. They are seldom welded up, more frequently being made in halves so that when put in place they may butt well again each other at the ends. The complete rings should be an inch greater in diameter than the outside of the flue; washers being provided, through which rivets pass, so that the water may circulate freely between the flue and the ring.

P. B. (Glasgow).—Your steam-pipe is greatly too small; replace it by one double the diameter, carefully clothed.

C. Y. (Brighton).—It seems to be an established rule that the air-vessels of fire-engines can scarcely be made too large.

RECEIVED.—C. W.—E. B. D.—M. O.—W. L. and Co.—J. W.—T. B.—C. F. and Co.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

THE STEAM PROBLEM.

HALL'S PATENT SECTIONAL DRUMS AND ROPE FOR STEAM CULTIVATION.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The diagram on the next page is intended to represent my steel link chain rope passing round two drums, each under a 6-horse power traction engine, working on the opposite headlands of a field in the direction shown by the arrows, for the draught of cultivating implements.

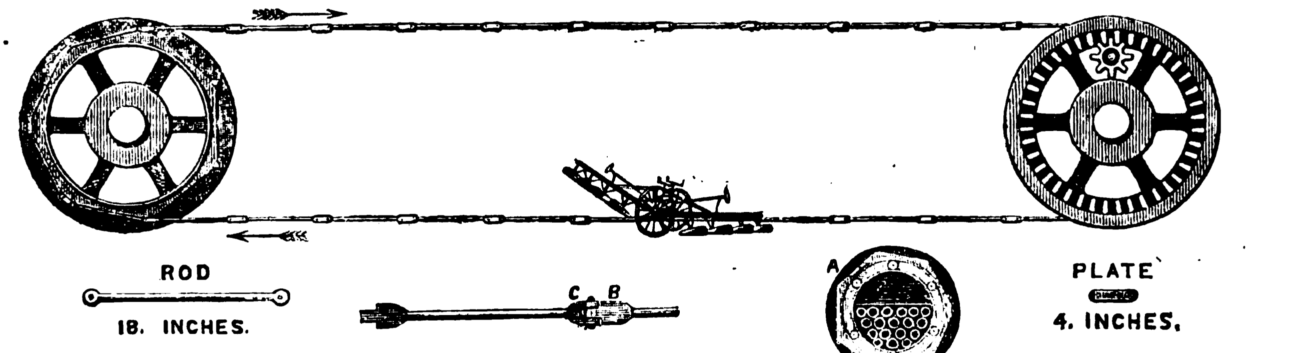
For this purpose, no unity or simultaneous action of two engines has hitherto been practical. We saw at the Worcester Royal Agricultural Show the two very effective 12-horse power engines of Mr. Fowler acting alternately, and the second prize engines of Savory and Son also acting alternately, no means having been devised for uniting their powers.

My rope and drums being a piece of elongated gearing, enables me to use, not two 12-horse power engines, as the above-named gentlemen did, but two of 6-horse power acting together, the united force of which is equal to all heavy land tillage, and by their light, portable, and diminished capacity and consumption of fuel, are better adapted to the other requirements of the farm for thrashing, chaff-cutting, &c.

A represents my sectional drum around the boiler in place of the circular drum and wire rope, as used by Messrs. Savory and Son, and patented by me in February, 1859. C B is another form of rope that will pass around it; but I prefer the plates.

I think it will be readily admitted that a rope

HALL'S PATENT SECTIONAL DRUMS AND ROPE FOR STEAM ENGINES.



formed of ½-in. solid steel rods riveted together, has a superiority over one composed of fine steel wires woven together, which at best is a delicate fabric, and soon destroyed by friction, rust, and unequal [illegible] in in passing over a gritty soil and small drums.

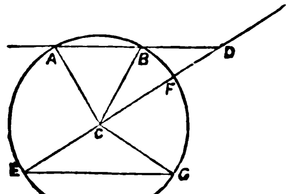
The above system was shown in action at Worcester during the three days' show, and the ploughing (Plot No. 6) was acknowledged to be superior to the other work done, though my engine and tackle had never been at work before, but were exhibited in an incomplete state, rather than miss the opportunity altogether.

I remain, Sir,
Your most obedient servant,
COLLISON HALL, Sen.

Prince's Gate Dairy Farms,
Near Brentwood, Essex.

TRISECTION OF AN ARC.

SIR,—The trisection of an arc or an angle is generally considered a geometrical *crux* of the same character as the construction of a square equal to a circle, of which I sent you a solution lately. The other problem may be solved with equal facility, and by means exactly analogous to the recognized method of drawing an ellipse by a point on a stick of which the ends slide along two straight lines at right angles—or indeed any angle—to each other.



Let AE be the arc, or ACE the angle, to be trisected. Draw the straight line ECFD projecting beyond the circle. Take a straight stick, with the length of the radius BD = AC marked off from one end, and slide that end along FD, keeping the stick on A, until B coincides with the circumference; then BF will be = $\frac{AE}{3}$, or BCF = $\frac{ACE}{3}$.

PROOF.—Draw EG parallel to AB; ∴ BG = AE, and GED = ADE = BCD, because CB = BD; and FCG, the angle at the centre, = 2 FEG, the angle at the circumference, = 2 FCB; ∴ BCF = $\frac{BCG}{3} = \frac{ACE}{3}$.

It is right to add that this proof, though not the construction above, is taken from Mr. Potts's Euclid, p. 162, 5th edition. If the angle to be trisected exceeds 135 deg., this construction becomes impossible, because then BD becomes a tangent. In that case, bisect the angle first, and then trisect it, and double the resulting angle.

E. B. DENISON.

INDIAN RIVER STEAMERS.

SIR,—I read with interest, in your number of July 3, the report of Mr. Leys' Paper on Indian River Steamers, read before the Scottish Shipbuilding Association, March 2, 1863. In it I find the following:—The Indus Flotilla Company had a steamer built on the Thames by a celebrated builder, and tried on that river. Her dimensions were:—Length, 200 ft.; beam, 38 ft.; and depth of hold, 8 ft. She was propelled by a condensing three-cylinder oscillating engine, two of the cylinders being below and the third above deck. At her trial on the Thames she attained a speed of 13 miles per hour with 688 indicated horse-power; her draught of water was 1 ft. 11 in., and her immersed midship section 70 ft."

Immediately after he says:—"There were other six steamers built from this model one, and, from my last account, only one of them had been tried. The results were so unfavourable that not one of them was taken off the contractor's hands after being put up at Kurrachee, the Company having purchased some of the boats belonging to the East India Company, and are carrying on their trade with them."

From these two statements, it would be natural to infer that the "other six," as well as the "Stanley," were built by the same celebrated builder. Such is not the fact. I was engaged in building the "Stanley," which, as Mr. Leys states correctly, went 13 miles an hour on the Thames, drawing only 23 in. of water, and in the shallow water of the Indus, 10 miles an hour—a performance admitted to be the greatest ever obtained there.

I may also add that on the Thames she towed a collier brig, with 350 tons of coal on board, at the rate of 9 miles an hour, her draught being, as above, 23 in. These results, I think, show her to have been remarkably successful. The "other six" vessels, which Mr. Leys asserts were failures, were neither built nor engined by the builder of the "Stanley," nor do the engines and boilers at all resemble the three-cylinder engines and boilers of the "Stanley," which continues to maintain her speed and power in water where none of the others have yet been able to make a single voyage. The author may have been misled by the fact that competing tenders were taken for exact copies of the model boat, the "Stanley;" but the tenders accepted were those of parties who professed themselves able to make great improvements on the machinery and boilers of the "Stanley," which improvements consisted in an entire abandonment of the model in the construction of those vessels of which Mr. Leys truly says the results were so unfavourable that not one of them was taken off the contractor's hands.

It is true the "Stanley" broke down from the failure of a piston-rod; but this accident resulted from the owners not sending out a spare one; they therefore continued working the vessel after they discovered a flaw in it. The vessel which Mr. Leys describes as suitable for shallow rivers, is a description of the "Stanley" with some modifications which I think are not improvements. He says truly, that "light draught is of the utmost importance combined with strength and moderate speed."

It requires very little proof to show that this can be done best by making the vessel as short and wide as possible. In two rectangular tubes of the same length and depth the area of metal in the cross section must be the same for the same strength; hence the weight per foot must be the same, whatever the width; but in order to get the same displacement at the same draught, Mr. Leys must lengthen his vessel to 250 ft., or one-fifth of the whole length; but since the strength varies inversely as the length, it is obvious that he must add one-fifth to the sectional area; therefore, the long, narrow ship of equal displacement and strength weighs one-fifth more per foot than the short wide one—that is, if the iron hull of the long narrow one weighs 100 tons, the short wide one weighs only 70 tons.

The short wide ship will also steer more quickly than the long narrow one—a not unimportant matter where the navigation is difficult.

The arrangement of barges which Mr. Leys advocates is the same in all respects as that provided for in the "Stanley."

The relative merits of high and low pressure engines for such vessels I cannot enter into now, for I fear I have already trespassed too much upon your patience; but the subject of light-draught steamers is an interesting one.

My principal object in writing is to point out that the "Stanley" was eminently successful as regards her speed and power of navigating the river Indus, and that the "other six," which proved failures, were not built or engined by the builder of the "Stanley," nor was she taken as a model to be imitated. I have also endeavoured to show that the vessel which Mr. Leys proposes is the reverse of an improvement upon the "Stanley."

Yours, &c.,
MORGAN H. DAVIES.

Blackheath-hill, July 27, 1863.

Miscellanea.

The total number of registered steam vessels in the United Kingdom on or before the 1st of January, 1863, was 2,192, the amount of registered tonnage being 535,596, and the amount of gross tonnage, 810, 538.

A large cylinder has been constructed at the Caledonian Foundry, Kilmarnock, by Mr. Andrew Barclay, for the Coltness Iron Company. It is 84 in. in diameter, 15 ft. or 16ft. in length, and weighs about 19 tons. It is the largest of the kind ever made in Scotland, and its says much for the skill and enterprize of Mr. Barclay that he has carried off the palm from Glasgow tself in this line of workmanship. This is the second large-sized pumping engine which has been constructed at the Caledonian Foundry for the same company.

The striking feature in the passenger traffic in India still continues to be the enormous preponderance of third class travellers. In the year ending June 30, 1862, there were 61,817 first-class passengers and 299,820 second-class, but no less than 6,447,055 third-class, to whom may be added 342,958 who travelled fourth-class, while carriages of that class were run.

The oldest vessel afloat has just been condemned on the Peruvian cost. She was ninety years old. This was none other than the the whaling barque Maria, of New Bedford, United States. She was the first ship which carried the United States flag in the British Channel after the great revolution.

We learn from the *Army and Navy Gazette* that the first heavy gun made in the royal gun factories with an internal tube of steel instead of wrought iron, was, on its completion a few days since, at once put to its work of testing the Armstrong 100-pounder vent-pieces. This gun has now stood 300 rounds with proof charges, and shows no sign of alteration either in the interior tube or on the outside, a result that must be highly satisfactory to Mr. Anderson, to whom this improvement in gun manufacture is due. It is true that small pieces of steel have been for years past tempered inoil, but the application of oil to temper gun blocks or other large masses of steel was, if not untried, at least not so succesfully carried out as to cause itsadoption.

The screw steamer "Italia," whose trial trip we noticed a short time back, belonging to the fleet of the London and Mediterranean Steam Navigation Company, has just completed her first voyage

to Genoa in 9 days 18 hours, which, considering the very unfavourable weather she encountered throughout the whole voyage, is believed to be the quickest on record. The excellent working of the engines reflects the highest credit on the engineers, Messrs. Maudslay, Sons, and Field, who have fitted two other vessels belonging to that company with similar engines.

It is worth knowing at this time of the year that meat may be kept sweet for a long time in an atmosphere strongly impregnated with acetic acid. The meat is placed on a wooden support, or suspended in a close vessel, on the bottom of which some strong acetic acid is poured.

During the visit of the Lords of the Admiralty to Woolwich Dockyard on Tuesday, they witnessed a series of experiments with the challenge steam fire-engine constructed by Mr. W. Roberts, of Millwall, for the performances of which at the Crystal Palace the patentee has received a special vote of commendation from the Steam Fire-engine Committee, of which the Duke of Sutherland is chairman. The engine, with its pipes and all necessary gear, weighs 1¾ tons, and was conveyed from Millwall to Woolwich by three horses, the whole of the firemen being well accommodated on the vehicle. Steam was got up from cold water in eleven minutes, and the engine was worked up to pressure of 140lb., a powerful jet of water being propelled to a height of 182 ft. Mr. Roberts, is now engaged in preparing an experimental engine for the War Department.

The benefits attending the use of various substitutes for brass or gun metal in bearings is well understood by engineers. Some interesting experiments to decide the relative merits of the patent anti-attrition, and gun metal, took place about a year ago on the London, Chatham, and Dover Railway, and on the London and North-Western. The results are too long for an insertion more *in extenso*, but we have selected the following as sufficiently suggestive. Two patent anti-attrition bearings, weighing 10 lb. 14½ oz., were fitted to a second-class brake carriage on the first mentioned line, on the 23rd of June, 1862. They were removed on the 23rd of August, and weighed 9 lb. 15 oz., thus wearing at the rate of 7½ oz. per month. Two gun-metal bearings fitted on the same day to the same brake weighed 12 lb. 14 oz. On their removal, they weighed 10 lb. 13 oz., having thus lost 16½ oz. during the month. Such facts are sufficiently suggestive of the saving to be effected by the use of such a material.

The following scrap is from Cyrus Redding's "Yesterday and To-day."—It could not be many years after 1720 that the first engine was erected in Cornwall, near the North Downs at Huel Hose, seven or eight miles from Truro, and Mr. Joseph Hornblower was the engineer, who had been sent for into Cornwall on purpose. It may be interesting to know that it required three hands to work Newcomen's first engines. I have heard it said that when the engine was stopped, and again set at work, the words were passed, "snift, Benjy!" "blow the fires, Pomeroy;" "work away, Joe!" the last let in the condensing water. Lifting the condensing clack was called "snifting," because on opening the valve the air rushing through it made a noise like a man snifting. The fire was increased through artificial means by another hand, and all being ready, the machine was set in motion by a third."

We understand that a company is being formed for the purpose of supplying the metropolis with a main trunk underground railway. The suggestion appears to be due to Mr. Charles Baylis, of the Poultry, who has for some time recommended the construction of such a line of railway, to commence at Stratford, in Essex, to proceed to Bow, Mile End and Whitechapel Roads, through the City, down Holborn, Oxford-street, and Bayswater-road, and terminate at Shepherd's-bush, Middlesex. According to Mr. Baylis's suggestion, it is to have four lines of rails, at the least; and is to be furnished with chambers, for the care and keeping of gas and water pipes, telegraph wires, or any other desirable purposes. An opening in the road of say 7 ft. wide, will here and there be left to furnish light and air.

The directors of the Pneumatic Despatch Company state, in their report, that the experimental tube and machinery have been removed from Battersea, and laid underground from the Euston Station of the London and North Western Company to the District Post-office in Eversholt-street. The length of the tube is 600 yds. On the 20th of February last the Post-office authorities intrusted the company with the transmission of the mails. From that date the service of the district has been entirely performed by the company. Thirty trains per diem (Sundays excepted) have been despatched, with perfect regularity, and upwards of 4,000 trains have run without impediment or delay. The time occupied in the transmission has not exceeded 70 seconds. The daily cost of working has averaged £1 4s. 5d., and five times the number of trains could have been conveyed without any appreciable increase of expense. Confirmed in their views by this result, the directors proceeded to carry out the decision of the last general meeting by the issue of a capital sufficient to enable the company to lay a main line of tube 54in. in diameter, with the necessary stations, appliances, and machinery, from the Euston station to the General Post-office in St. Martin's-le-Grand, and forward to Gresham-street. This capital having been subscribed, the directors entered into contracts with Mr. Barrow, of Stavely, Messrs. James Watt and Co., and Messrs. John Aird and Son, for its completion. The length of this tube will be nearly 2¾ miles, and the entire cost, so far as can be foreseen, including the laying, station accommodation, and the necessary apparatus and pumping engines, will be about £65,000. The whole route has been carefully examined and definitely determined. From the active measures taken by the contractors in the preparation of the tubes and engines, the directors hope to commence laying the line at an early date, and will press forward its completion with all practicable expedition. A considerable portion of the further issue of shares has been taken up by the original proprietors and the contractors, and the remainder has been allotted among 76 new shareholders.

We learn, from a Newcastle paper, that Mr. Dryden and Alderman Robinson, two of the River Tyne Commissioners, accompanied by Mr. Guthrie, their secretary, and Mr. Wake, harbour master, Mr. Ure, their engineer, Mr. Messent, the engineer of the Tyne Piers, and other gentlemen, visited the new dredger, No. 5, moored off the New Quay, North Shields, on Friday last. This stupendous machine, which was constructed by Messrs. T. Wingate and Co., of Glasgow, for the Commissioners, was launched into the Clyde on the 1st inst., and left two days afterwards for the Tyne, under the command of Captain Bell. She was accompanied by Mr. Ure, and went "North about," encountering near the Orkneys on her voyage some heavy seas, which proved her to be a good sea-boat. She arrived in the Tyne on the 10th, and was immediately fitted for operation. The Commissioners and officers went down to the new craft at seven o'clock in the evening on board their steamer, and after inspecting the craft and the steam-engines, the order was given to set the machinery in motion. The two ladders, each containing 35 baskets, and weighing upwards of 100 tons, were easily managed by a single man at each pulley, and were let down upon the bottom of the river, and very soon gave evidence of their powers, working without the slightest check from the moment the engine was started, and in the space of little more than an hour filling two of the Commissioners' hopper-barges, one on each side, and each containing 300 tons of mud and water. Mr. Wingate directed the trial of the engines and machinery, which was completely successful. A novelty of the construction is the manner in which the power is communicated by the engine to the dredging apparatus by means of the friction wheels of Robertson, of Glasgow, instead of the toothed or cog-wheels generally in use. The new wheels seem to answer admirably. It is calculated that the new dredger, when in full operation, will raise 10,000 tons of material per day, and we believe we are not mistaken in saying, will be one of the most powerful dredgers in Europe. The engine is of 50-horse power nominal, and is capable of being worked up to three times that power. Each bucket weighs a ton and a quarter, and the ladders are calculated to operate in 30 ft. water, and when working at speed, will each fill a hopper-barge in from 50 to 55 minutes.

The annual congress of mechanical engineers is to meet in Liverpool on Tuesday, the 4th of next month, and its sittings will extend over the Wednesday, Thursday, and Friday of that week. An efficient and active local committee has been formed. Mr. William Clay, managing partner of the Mersey Steel and Iron Works, having been appointed its chairman, and Mr. William Stubbs its secretary. The arrangements have been all but completed, and these are such as to give assurance of a highly interesting meeting. The congress is to assemble each morning in the Concert-room, St. George's-hall, where papers will be read and discussed, after which excursions will be made for the purpose of examining the noteworthy establishments in Liverpool and its vicinity. The steam-tender "Satellite" has been most kindly placed at the service of the committee by Mr. C. MacIver, and the railway companies offer every facility to the members for visiting the various places of interest. The programme of proceedings has not yet been officially announced, but we understand the following, among other places, will be visited, namely:—The Mersey Steel and Iron Works; Messrs. Laird's Shipbuilding-yard; Bibby's Copper Works, at the Great Float; the Dock Board's chain-testing machine; the North Docks. Visits of inspection will also be made to the Plate Glass Works at St. Helen's; Messrs. Pearson and Knowles' Collieries, near Wigan, and to the Kirkless-hall Iron Works; and also to the London and North Western Railway Company's Locomotive Works at Crewe. During the meeting there will be a grand banquet in St. George's-hall, under the auspices of Mr. Robert Napier, of Glasgow, the President of the Institution, and, so far as can be gathered from present appearances, the meeting promises to be highly interesting and successful. The congress last year was held in the Mansion House, London, and was in all respects very interesting.

It appears from a parliamentary return, that the Armstrong guns supplied by the Elswick Ordnance Company to the Government have cost in all £394,660 6s. The guns supplied from Woolwich have cost £445,205 7s. 9d. The Armstrong shot and shell, including fusees, supplied by the Elswick Company, cost £414,194 5s. The shot and shell supplied from Woolwich cost £142,930 8s. 7d.; making a total—which, we may remark, is exclusive of any expenditure which may have been incurred for machinery, alterations, repairs, and fittings required for the manufacture of Armstrong guns—of £1,396,990 7s. 4d.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 3421.
BOILERS AND FURNACES, 3430.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 3422, 3428.
SHIPS AND BOATS, including their fittings, 3434.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 3425.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 3443.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 3420, 3424, 3431, 3433, 3436, 3542, 3444, 3445.
BUILDINGS AND BUILDING MATERIALS—*none*.
LIGHTING, HEATING, AND VENTILATING, 3412, 3417, 3427.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 3437, 3439, 3440, 3448, 3460, 3461, 3467.
METALS, including apparatus for their manufacture, 3414, 3426, 3438.
CHEMISTRY AND PHOTOGRAPHY, 3418, 3423, 3429.
ELECTRICAL APPARATUS, 3411.
WARFARE, 3435.
LETTER-PRESS PRINTING—*none*
MISCELLANEOUS, 3413, 3415, 3416, 3419, 3432, 3441, 3446.

3411. F. C. BAKEWELL. *Improvements in transmitting and receiving communications by means of electricity.* Dated December 22, 1862.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

3412. J. MCLEAN. *Improved apparatus or arrangements for obtaining oil and other products from shale and the like bituminous minerals.* Dated December 22, 1862.

The improved apparatus for carrying out this invention comprises a number of cast-iron retorts disposed horizontally, and, by preference, in sets of three to each furnace. Each retort is about 7 ft. 6 in. long, by 3 ft. wide, and 1 ft. 6 in. deep, all as measured internally, of a fair oval form in cross section, and about 2½ in. in thickness. Two of the retorts are disposed within 1 foot 4 in. of each other, and the third is placed in the centre space above them, the three being arched over. The furnace grates are about 3 ft. 6 in. in length by 2 ft. wide, and 3 in. fire brick flags are interposed between them and the retorts to support the latter. The retorts are fitted with doors of boiler plate, which are fixed by cross bars, screws, and levers, and each retort is provided with two outlet pipes by which the dis-

tilled products pass off. The outlet pipes are passed through condensing cisterns provided with feed and overflow pipes, and kept constantly free of cold water, and on leaving the cistern the pipes descend vertically downwards to the lying pipe or main by which the products of the several sets of retorts are conveyed to the collecting tank. A second condensing apparatus is provided for any overflow of gas or vapour not condensed in the first cistern, and at a part of the main before it reaches the collecting tank an outlet is provided for separating the ammoniacal liquid from the oil. *Patent abandoned.*

3413. W. FRANCIS. *Improved apparatus for cutting soap.* Dated December 22, 1862.

In carrying out this invention, the inventor makes a frame of the same length as bars of soap are generally made, and of a width corresponding thereto, in which frame are fixed knives of a peculiar shape, placed at proper distances to cut the soap into pounds, half-pounds, or quarter-pounds, at the will of the operator, the knives being moveable, so as to admit of the soap being cut into only pounds, or, if desired, pounds and half-pounds, or pounds, half-pounds, and quarter-pounds. To give strength to the knife blades, and also to keep them immoveable while they are being used, they are made with a screw at each end; the ends of the knives being square are let into the sides of the frame and then tightened by means of the said screws, which renders the cutting easier. When the cutter is used, a quantity of soap is simply placed in a heap (one bar on another), the cutter carefully placed on the top, then pressed down, thereby cutting through the soap, and leaving it ready to be wrapped up in paper, without the necessity, as a rule, of it being weighed, the frame being so adjusted as not to require it; but it is not solely for the purpose of dispensing with the weighing apparatus, but also for facilitating the cutting up of soap for sale in pounds, half-pounds, and quarter-pounds. *Patent abandoned.*

3414. A. S. STOCKER. *Improvements in rolling iron for the manufacture of tips and other articles.* Dated December 22, 1862.

This invention (which refers to a previous patent, dated March 17, 1862, No. 728), relates to rolling iron applicable to the manufacture of boot heels and toe tips plain on both its surfaces. The patentee produces the iron in two or more bars, and afterwards divides them by the aid of shears or otherwise. *Patent completed.*

3415. G. E. M. GERARD. *Improvements in the fabrication of threads from vulcanized india rubber and the apparatus connected therewith.* Dated December 22, 1862.

This consists in cutting bands or sheets of vulcanized india rubber with little or no waste and great rapidity into threads of perfect regularity, and the ends of which are united by a sort of selvage formed of the edge of the band or sheet. *Patent completed.*

3416. E. B. DANN. *Improvements in goffering apparatus.* Dated December 22, 1862.

This invention consists in forming the bars used in goffering apparatus in two or more parts, or bent at angles, one part of each bar to the next of it, or in series of curves, in place of such bars being straight, round, or flat as heretofore. The patentee forms the bars of various sizes of angular or other section, and in series of the same or varying sizes, corresponding with the form to be produced. *Patent completed.*

3417. R. A. BROOMAN. *Improvements in stoves or apparatus for heating and drying.* (A communication.) Dated December 22, 1862.

This invention consists in the construction of apparatus for heating and drying, in which the air is heated by being caused to circulate in a zigzag direction through a casing surrounding pipes and chambers, in which the products of combustion, from a stove, are made to pass all as hereafter described. The stove consists of a grate, with a dome-shaped casing above it, in communication with a series of chambers one above the other, and connected by pipes, each chamber containing plates for dividing the products of combustion in their passage to the outlet or chimney. The apparatus just described is enclosed in a casing, with division plates alternately fixed to each chamber. Air is admitted near the bottom of the apparatus, and, circulating round and in contact with the chambers, is heated, and passes upwards in a zigzag direction, to be used for heating or drying as required. *Patent completed.*

3418. M. CLARK. *Improvements in treating waste liquors obtained when dyeing Turkey red colours.* Dated December 22, 1862.

In the process of Turkey red dyeing by the new or machine process, a liquor is produced containing water, carbonate of potash, or soda, or a mixture of these two salts, and olive or other oil. Before running off this liquor, sulphuric, nitric, muriatic, or other acid is added. This separates the oil from the potash or soda solution, causing it to come to the surface. The oil is then skimmed off; and the liquor remaining has hitherto been considered waste and runs away to the stream. This invention consists in utilizing this waste liquor, by artificially heating the same in order to evaporate it, and then to crystallize the sulphate, nitrate, muriate, or other salt of potash or soda, depending on whether potash or soda (or a combination of the two) was the alkali used. *Patent completed.*

3419. J. B. DALHOFF. *Improvements in cutting files, and in machinery to be employed for that purpose.* Dated December 22, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3420. C. FARRAR. *Improvements in machinery or apparatus to be employed in treating certain fibrous materials.* Dated December 22, 1862.

This invention has reference to improvements in machinery or apparatus to be employed in the boiling and cleansing of rags or other fibrous material applicable to paper-making or other manufacturing purposes, whereby the said process of boiling and cleansing is more effectually and expeditiously performed than at present, and consists in employing, in connection with a rectangular vessel or boiler charged with water or otherwise, to which heat is applied, an open work cylinder, drum, or cage, mounted horizontally, so as to contain the goods under operation, and to travel or revolve slowly within the same, the open work cylinder or drum being mounted upon short disconnecting trunnion bearings, through the medium of glands or stuffing-boxes, fixed upon the ends of the said boiler, in lieu of a continuous or solid shaft, for the convenience of lifting the same in or out of the boiler, and discharging the contents thereof; employing, also, with the above apparatus for the washing and cleansing process, an open work cylinder or cage, in like manner mounted and caused to revolve upon hollow trunnion bearings, through which water or steam is admitted to the goods contained therein under operation, and in enclosing the same within an outer case or tank, provided with outlet ways or passages. *Patent abandoned.*

3421. C. PIEPER. *A new improved governor for steam-engines, turbines, water-wheels, and other machinery, with valvular arrangements to regulate the speed of the same.* Dated December 23, 1862.

The documents relating to this invention are with the law officers, and cannot at present be seen.

3422. F. PARKER. *Improvements in carriages.* Dated December 23, 1862.

This invention consists—1, in connecting the shafts or front bar directly to the axle by means of steering irons or tension rods connected therewith, thus giving to the ends of the springs liberty to play along the shafts, through the medium of sockets or rings passing round the shaft in connection therewith, instead of at one of the said ends only, as at present; 2, in attaching one end of the springs to the shafts by means of iron clips or bands passing round the same, in lieu of lug plates bolted through the shafts, where it may be necessary to leave one end only of the springs at liberty to play; 3, in the employment of india rubber, gutta percha, or other flexible material combined with metal, instead of being entirely of iron (as at present) for forming or manufacturing the sockets or rings through which the shafts play by the expansion or contraction of the springs when in motion; 4, in placing and fixing the shafts at the sides of the elliptic springs, in place of passing them between the upper and lower halves thereof, when found desirable, the shafts being connected or attached to the ends of the springs by either of the methods herein described; 5, in the employment of springs of substance proportionate to the minimum weight intended to be carried, in connection with auxiliary springs, arranged so as to be brought into play when additional weight is placed on the carriage, in lieu of springs proportionate to the maximum weight (as at present employed); as also in placing the auxiliary springs either within the same or parallel to the ordinary springs, so that, when a certain amount of weight is placed upon the carriage, the ends of the upper halves of the auxiliary springs may be brought together and made to rest upon the lower halves thereof, through the medium of india-rubber pads attached to the ends; 6, in the employment of clips or bands for attaching the upper halves of the springs to the body, and the lower halves to the axle, in like manner, whereby a more effectual method of securing the same is effected than by passing the bolts through the springs as hitherto; 7, in the employment of bearings of india-rubber placed between the body and the upper halves of the springs, as also between the lower halves of the springs of the axle for lessening or checking concussion, noise, and wear and tear when in use. *Patent completed.*

3423. R. A. BROOMAN. *A new or improved colouring matter or dye.* (A communication.) Dated December 23, 1862.

The object of this invention is the production of a new colouring matter for dyeing and printing, which the inventor terms "Imperial Ruby." The colour (the normal tone of which is a cerise, or its derivative shade) is obtained by the combination of fuchsine and coralline, or any other yellow or orange colour extracted from coal. Process:—The fuchsine and coralline are dissolved, together or separately, in methylated spirit, acetic acid, alcohol, or other spirit. The coralline predominates in quantity over the fuchsine; thus, to obtain the normal tone of imperial ruby, the inventor takes, say, three parts of coralline to two parts of fuchsine. These proportions may, however, be varied; any excess of coralline in the dyeing bath tends to produce a yellower cerise, while an excess of fuchsine, on the contrary, imparts a more violet shade; thus, by varying the proportion of one or other of the products, all the graduations of shades of cerise and its derivatives may be obtained. *Patent completed.*

3424. C. A. F. COLLETTE. *A new kind of lace, to which it is intended to give the name of "Collette's" laces.* Dated December 23, 1862.

This invention consists in the reproduction, in coloured silk lace, of all natural, artificial, or fancy flowers, or of any other coloured designs or patterns to be applied to various uses, such as ornamental flowers for state robes, ball-dresses, parasols, screens, fans, and all sorts of articles of the same or other kinds. In order to obtain these various products, the inventor first punctures the model or pattern to be reproduced on cartoons; he then proceeds in the ordinary manner of making common lace, but with as many bobbins of silk of the required colour as may be necessary, that silk known as Alais silk being preferred. He does not restrict himself to that kind of silk, however, as several other materials, such as bobbin, flat core, twist, brass, and iron wire; and other kinds may be used, according to the work required to be done. *Patent abandoned.*

3425. J. PATTERSON. *Improvements in machinery or apparatus for grinding, crushing, cutting, cleaning, and hulling, or shelling various kinds of farm or vegetable produce, also applicable to the crushing or grinding of minerals and other substances.* Dated December 23, 1862.

The present improvements have reference to that class of mills wherein the surfaces between which the substance to be ground or otherwise operated upon, consists of discs placed parallel or nearly parallel to each other, as in the case of a pair of ordinary millstones. The surfaces themselves may consist of ordinary grinding stones, or of steel, or any other suitable material. According to this invention, in place of imparting to the runner a simple rotary motion on its axis, it is proposed to impart a compound or twofold motion thereto, by causing it to revolve round its own axis, whilst at the same time such axis itself is made to describe an orbit round an imaginary axis. By this compound motion of the runner a wrenching or compound action is obtained upon the substances to be ground or otherwise operated upon, in addition to the effect produced by the ordinary motion of millstones or other similarly arranged guiding surfaces. *Patent abandoned.*

3426. E. B. WILSON. *Improvements in apparatus to be employed in the manufacture of malleable iron and steel.* Dated December 23, 1862.

This invention relates to a peculiar construction and arrangement of what are known as atmospheric converting vessels employed in the manufacture of malleable iron and steel, whereby they are rendered more firm and steady under operation than converting vessels of the ordinary construction. According to this invention it is proposed to dispense entirely with the axis, pivots, centres, or trunnions hitherto employed in suspending converting vessels, and to cause such vessels to turn or rotate upon hoops or rockers fitted thereto. *Patent abandoned.*

3427. G. HASELTINE. *Improvements in the mode and apparatus for converting petroleum or coal oil into gas for lighting and heating, the said improvements being especially applicable to lamps and stoves.* (A communication.) Dated December 23, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3428. J. WHITLEY and J. W. BURTON. *Improvements in the construction of the permanent way of railways, which improvements are also applicable to railway wheels.* Dated December 23, 1862.

This invention consists in the application of a packing or cushion of wood, paper, or felt between the connecting plates or fishes for connecting the rails together and the rails. These cushions may be compressed and chemically prepared, as is well understood, to aid in their preservation from the action of damp. *Patent completed.*

3429. S. RUSSELL. *Improvements in stereoscopes.* Dated December 23, 1862.

For the purposes of this invention, the patentee constructs an instrument in the form of a box, of a length, depth, and width suitable for containing, when out of use, a number of stereoscopic slides or pictures. The instrument is closed by a sliding or other suitable cover when out of use, and on the interior and against one side mirrors are fixed. Not only may the top have a moveable cover, but the bottom also may be made moveable, so that when in use a stereoscope may be open both at top and bottom when desired. The lenses or eye-pieces are fitted in apertures in the lower part of the opposite side of the box, this part of the side being suitably inclined to the plane of the mirrors. The stereoscope pictures or slides are, when about to be observed, placed in suitable grooves or holders opposite the mirrors, and on the side where the lenses or eye-pieces are applied, they are held in a position inclined to the plane of the lenses, and also to the plane of the mirrors. By this arrangement no reflector is required to throw light on the picture, but the light falls directly on it so as to illuminate it thoroughly. *Patent completed.*

3430. T. C. HINDE. *Improvements in furnaces or apparatus for generating carbonic oxide.* Dated December 24, 1862.

This invention consists of certain improvements in furnaces or apparatus for generating carbonic oxide, whereby the said carbonic oxide may be conveniently and economically made from small anthracite, or other small coal or coke, as well as from large coal or coke. The said carbonic oxide may be used for heating steam boiler and other furnaces, and for various other purposes. *Patent completed.*

3431. S. HASLAM and A. EATOUGH. *Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.* Dated December 24, 1862.

Instead of one doffing cylinder with card teeth, as hitherto adopted, the inventors employ two cylinders, each mounted with belts or bands of felt, flannel, or other similar material, so as to leave spaces between them. The cylinders are placed in relation to each other in such manner that the belts on one cylinder enter the spaces of the other cylinder, and when revolving motion is given to the cylinders slivers are taken off the main card cylinder the same width as the belts, instead of one wide fleece, as at present. *Patent abandoned.*

3432. G. H. BIRKBECK. *Improvements in instruments for surveying and levelling.* (A communication.) Dated December 24, 1862.

This invention has for its object the arrangement and combination of parts so as to form a compound surveying instrument, to be called a "level-graphometer square," which is capable of executing the various operations which each of the above-named instruments is only capable of performing separately. This improved instrument is composed of a cylinder of brass, or other suitable metal, divided longitudinally with its axis into two equal parts, connected together by a central pin or axis, thus forming two cross-staffs, to each of which "pinicles" are hinged, so as to fold down out of the way when out of use. Between the two semi-cylindrical parts a dial or plate having divisions thereon is fixed and used. When the instrument is employed as a "graphometer," the instrument in this case is mounted, by means of a screw-pin or otherwise, upon a suitable stand or support. When the instrument is employed as a level, it is suspended by a ring attached to the upper end thereof, and it is accurately adjusted perpendicularly by a moveable weight actuated by an adjustable screw attached to the lower end. Sight holes or openings are formed through the

moveable semi-cylindrical part of the instrument, through which the divisions on the dial plate may be seen and read off when required, a fine wire or thread being stretched across each aperture in the direction of the line of sight. Flat plates, connected by a central pin or axis, may be substituted for the semi-cylindrical parts before described, by which the construction of the instrument will be simplified, but its form will not be so elegant. The divisions on the dial plate are in sections of five, or other suitable number of degrees, so that the instrument acts not only as a "square" (which, in other respects, it replaces very advantageously), but it also admits of small angles being taken, as with the "graphometer." *Patent completed.*

3433. J. BROADBENT and J. ROBINSON. *Improvements in machinery for opening and cleaning cotton and other fibrous materials.* Dated December 24, 1862.

The nature of this invention consists in directing currents of air through apertures in the circumference of a toothed drum, or drum with beaters, forming part of an ordinary opening machine, which air not only strikes the fibrous material against the grid, and assists in removing the dirt and other impurities, but also carries the fibrous material forward against the usual wire cages from which it is carried in a fleece, and formed into a lap by the usual lap rollers. The currents of air pass through apertures in a line with the teeth or beaters, and strip the cotton or other fibres off them; the air is admitted through openings in the ends of the drum, and is produced by a fan or by vanes placed within the drum. *Patent abandoned.*

3434. F. N. GISBORNE. *Improvements in the means for indicating the speed of ships at sea.* Dated December 24, 1862.

In carrying out this invention, the inventor employs magneto-electric currents, excited by a soft iron armature revolving before electro-magnets attached to a permanent magnet, and motion is given to the armature by the action of water upon screw fans attached to a shaft, at the end of which the armature is secured, in accordance with the speed at which the apparatus is towed through the water. The currents generally are conveyed through the insulated wires to a step-by-step electro-magnetic indicator, and the number of progressive movements within a given time will thus indicate the speed of the vessel. Sometimes he uses the revolving axis simply to make and break a galvanic current, which, in effect, answers the purpose hereinbefore mentioned. *Patent abandoned.*

3435. A. P. TRONCHON. *Some improvements in the construction of firearms.* Dated December 24, 1862.

This invention consists in forming a hole through the entire length of the stock, so as to communicate with the barrel; this hole is filled up with cartridges. Several means may be employed to facilitate the pushing of the cartridges and their introduction into the barrel. *Patent completed.*

3436. J. S. SMITH. *Certain improvements in looms for weaving.* Dated December 24, 1862.

Provisional protection has not been granted for this invention.

3437. W. C. GALLOWAY. *Improvements in pianofortes.* Dated December 24, 1862.

This invention relates to contrivances or means for modifying or softening the tone of the instrument at the will of the performer. In carrying out the invention, according to one modification, there is provided a kind of curtain or a layer of a suitable soft and elastic material, such as felt, leather, or rubber, which, by the action of a pedal or equivalent mechanism, can be interposed between the hammers and the strings, and which, by modifying the force of the hammers' stroke, will produce the required softening of the tone. The degree of modification of tone may be varied by the pedal or equivalent action bringing the interposed material more or less near to the hammers, so as to offer more or less resistance thereto; or a similar variation may be obtained by the interposed material being more or less tightly stretched. *Patent abandoned.*

3438. W. HENDERSON. *Improvements in obtaining iron and steel from certain ores and residual products.* Dated December 24, 1862.

In the manufacture of sulphuric acid from iron pyrites the residue consisting principally of oxides of iron still contains from 3 to 9 per cent. of sulphur and cannot therefore be used with advantage for the manufacture of iron. When copper pyrites or iron pyrites containing copper are used for this manufacture, the residue contains copper besides a certain proportion of sulphur which renders it still more unfit for the manufacture of iron. By treating burnt copper pyrites by the process for sulphuret copper ores, described in the specification of a previous patent granted to the present patentee dated 20th December, 1859, No. 2900, practically all the copper and sulphur are extracted and a very pure oxide or mixture of various oxides of iron remains as a residue. When found desirable iron pyrites residues containing no copper may be treated in the same manner and a very pure oxide or mixture of oxides of iron will be the result if the pyrites have been originally rich in sulphur. These residues, after treatment by the above process for the extraction of copper, are in a very fine state of division and cannot be used advantageously in a blast furnace for the production of cast iron. They produce little or no slag and pass rapidly through the furnace not properly reduced, choke the furnace, or are blown away by the blast. The present invention relates—1, To means of producing cast iron from these residues or a mixture of these residues with other ores. 2, To a method or methods of obtaining steel from these residues or a mixture of these residues with other ores or other substances. 3, To a method of obtaining malleable iron from these residues or a mixture of these residues with other ores. 4, To a method or methods of obtaining other qualities or compounds of iron from these residues either mixed with other substances alone or in conjunction with other ores. The details are voluminous. *Patent completed.*

3439. W. CLARK. *Improvements in the means of applying the feet in boots and shoes, and otherwise, part of which improvements is applicable to other heating purposes.* (A communication.) Dated December 24, 1862.

This invention relates to an improved apparatus of simple construction to be applied to the heel of a boot or shoe, for the purpose of warming the feet without danger of burning them. The apparatus consists of a hollow metal heel, with a false bottom, which is hinged to a metal sole piece, and serves to contain the charcoal used for transmitting warmth to the foot. The combustion of the charcoal when once lighted is maintained by the admission of cold air, which distributes the heat throughout the boot or shoe. The inventor applies a metal gauze to neutralize the effect of too strong a flame, which would be apt to burn. The lump of charcoal is maintained in position by means of a spring; the parts are also fixed by means of a spring button or pin, which serves for throwing off mud; or a spur may be substituted for the pin above mentioned. *Patent completed.*

3440. H. TWELVETREES. *Improvements in washing machines.* Dated December 24, 1862.

This invention consists in the combination in a washing machine of an endless web or belt, to which the clothes or other materials to be washed are attached, the rollers used having elastic pressing surfaces of india rubber. The endless web is conducted over suitable rollers to carry it down under the water or washing fluid, and upwards and between the india rubber rollers above the fluid. The belt is of a breadth, and conducted so as to traverse the area of the machine. The elastic rollers are situated at one extremity, while at the other extremity is another pair of rollers, the lower one of which serves as a conductor of the web, while the upper one resting on it has knuckles or projections formed on it, and which, by its weight, acts on the clothes in their passage between it and the conducting roller. The heavy knuckle roller may be further pressed down by springs taking effect on its axis. The clothes or other things to be washed may be secured to the web while it is in the machine; or the inventor sometimes makes such endless web to disconnect readily at one point, so as to remove it with the clothes; another web being used and ready charged may be at once introduced into the machine, and the time of the machine thereby economized. *Patent abandoned.*

3441. J. FAIRLESS. *Improvements in apparatus or machinery for milking cows.* Dated December 24, 1862.

This invention consists of an elastic pipe connected with four branches, which fit on to the teats of the cow; the other extremity of the pipe or tube communicates with an air pump, which is contained in the lid of an ordinary milk can, the lid being formed hollow for containing the necessary valves. This air pump consists of a flat disc of vulcanized india rubber, or other suitable material, which is moved upwards and downwards by means of a rod passing out through the top of the milk can, and actuated by a handle. The action is as follows:—The air being exhausted from the pipe or tube, by means of the air pump, the milk runs into the lid of the can, and by means of a valve opening outwards passes into the interior of the can. When no more milk can be got, the extra pressure of the air causes it to pass between the cones which fit on to the teats of the cow, so that they can be easily detached. *Patent abandoned.*

3442. R. LAKIN and J. WAIN. *Improvements in machines for spinning and for doubling cotton, and other fibrous materials.* Dated December 24, 1862.

The first of these improvements is applicable to certain machines for spinning, commonly known as doublers or twiners, in which the spindles recede from and approach to the creel, and consists in improved mechanism for regulating the winding on motion in the before-mentioned machines, when constructed with the screw usually attached to the radial arm known as Richard Roberts's. The second improvement is also applicable to the said machines called mules, and to such doublers or twiners as aforesaid, and consists of an improved arrangement and combination of mechanism whereby motion may be given from a shaft placed below the rim shaft to the scrolls or equivalents therefor, which draw in the carriage, and also to the cams or cam shaft, and to the backing off wheel. This shaft has attached to it a wheel, which receives motion from another wheel attached to the pulley on the rim shaft usually termed the loose pulley. The motion of this shaft when in rotation may be communicated as required by suitable means to the scrolls or equivalents therefor to the cams or cam shaft, and to the backing-off wheel. The third improvement is applicable to the machines called doublers or twiners, and consists in improved means of holding the threads during the operation of winding on in lieu of the jaws and slide usually employed. The fifth improvement, which is also applicable to doublers or twiners, consists in certain means of preventing or stopping the continued rotation of the cops or bobbins caused by the momentum they acquire during the drawing of the yarn from off them by the machine, so that the rotation may cease when the machine ceases to draw off. This the patentees effect by fixing a support or retarding surface, so that each cop or bobbin, or the skewer on which it is placed, falls against or comes in contact with the same when the machine ceases to draw the cop or bobbin, and thereupon the friction created by their contact acts as a break, and stops the rotation. *Patent ompleted.*

3443. E. STEVENS. *Improvements in machinery for preparing dough, and paste suitable for making bread, biscuits, pastry, cakes, and similar articles.* Dated December 24, 1862.

For the purposes of this invention, the patentee employs a mixing vessel, made by preference of sheet metal, galvanized or enamelled, or cast iron may be employed. The vessel is mounted on wheels, so that it can readily be moved from place to place. One of these wheels is a pivot wheel, and has a handle connected with it, by means of which the vessel can be drawn from place to place and readily guided. The bottom of the mixing vessel is made semicircular interiorly, and double, to contain in the space between the two parts warm water to facilitate fermentation. It should be fitted with a gauge and thermometer. In place of using water to warm the mixing vessel, it may be warmed by steam, hot air, or otherwise. In hot climates the mixing vessel will need to be cooled in place of heated. In addition to this mixing vessel he employs a fixed frame, consisting of a bed plate and two standards suitably tied together, and at such a distance apart as to receive the mixing vessel between them, and suitable turn buttons or clamps are provided for securing the mixing vessel in this position. To effect the mixing of the dough or paste when the materials have been placed in the mixing vessel, a horizontal cranked axis or bar, with inclined toothed stirrers upon it, is employed. The toothed stirrers may be made either round or rectangular in cross section, and may be much varied in form. The cranked axis or bar is of such a length as to be able to be placed in the mixing vessel, and it is of such a form that, when caused to revolve, it passes just clear of the sides and bottom of the mixing vessel. *Patent completed.*

3444. J. TAYLOR. *Improvements in engines for carding cotton and other fibrous materials.* Dated December 24, 1862.

This invention relates to mechanism to be used for the purpose of stripping the carded fibrous material from that card cylinder termed the doffer in carding engines, and it consists in the application to the doffers of carding engines of a combination of a roller and concave straight edge or disc. The roller rotates against the concave straight edge or surface, which is pressed slightly against the periphery of the roller for the purpose of giving it sufficient adhesion to take hold of and strip the material from the card surface of the doffer, and carry it past the concave straight edge or surface in the form of an endless fleece. *Patent completed.*

3445. J. and W. LORD. *Improvements in machinery for fluting rollers, used for preparing, spinning, and doubling fibrous materials.* Dated December 24, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3446. J. H. JOHNSON. *Improvements in apparatus for stamping or marking paper and other materials.* (A communication.) Dated December 24, 1862.

This invention relates to a peculiar construction and arrangement of ink stamper for marking papers and documents of all kinds, and for obliterating postage and other stamps, and consists of a rotating die contained in the lower end of a forked frame or holder, within which frame works vertically, by the action of the handle of the apparatus, an inking pad. On the stamp being pressed on to any surface, the pad descends and inks the upper surface of the die, which is provided with the proper type, according to the words or characters to be printed or impressed. A spring is employed for elevating the pad after the pressure of the hand is removed, and simultaneously with the rising of the inking pad a spring arm in connection therewith acts by means of a pin at its lower extremity upon a slotted disc fast on the end of the axis of the disc, and imparts on rising a partial or semi-rotation to the die, so as to bring the other surface upwards, whilst the other last inked is turned down in readiness for the next impression. In conjunction with the slotted disc there is a stationary cap fitted outside the disc, which cap has an inclined surface made therein, over which the pin slides in descending, but on arriving at the bottom of its course it drops into a curved an incline slot, which guides it into a semicircular course, and causes it to carry half round with it the disc and die. Thus at each depression of the handle the upper surface of the die is inked, and at each elevation or release thereof that surface is turned under, and a fresh one brought under the inking pad. *Patent completed.*

3447. D. G. HOPE. *Improved machinery for obtaining and applying motive power.* Dated December 24, 1862.

In carrying out the object of this invention, the inventor mounts upon the face of a vertical fly-wheel three or more cylinders, in such a manner that they will balance each other. These cylinders he fits with loose plungers, and he brings the cylinders into communication (by means of the hollow shaft of the fly-wheel and a pipe) with the working cylinder of the engine. This cylinder he fits with a piston, connecting rod, and a crank shaft, in the same manner as an ordinary direct acting steam engine, with the exception that the front end of the cylinder is left open. The plunger cylinders on the fly-wheel are so arranged, that one or other shall be horizontal at the same moment that the piston of the working cylinder arrives at the end of the stroke. *Patent abandoned.*

3448. A. V. NEWTON. *An improved construction of skate.* (A communication.) Dated December 24, 1862.

This invention consists in so constructing the runner of the skate that it will form in its transverse section a section of a circle or a curve approximating thereto, and in providing the runner with longitudinal blades or projecting edges to catch into the ice and prevent lateral slipping. The invention further consists in applying to the skate or pawl a hold-fast arranged on a hinge joint, so as to offer no obstruction to the progresses of the skater, but to prevent a backward movement of the skate upon the ice. *Patent abandoned.*

3449. J. PLATT and W. RICHARDSON. *Improvements in machinery or apparatus for disintegrating or pulverizing artificial manures, chemical salts, and other substances.* Dated December 24, 1862.

Provisional protection has not been granted for this invention.

3450. C. J. DENTON. *An improvement in the process of revivifying animal charcoal.* Dated December 24, 1862.

The object of this invention is to effect the drying of animal charcoal in the filters in which it has been used, or in the cisterns in which it has previously been revivified, by what is known as the wet process. This the inventor proposes to effect by introducing into the filters or cisterns (as the case may be) suitable heating apparatus, such as steam or hot air pipes or flues, or by throwing blasts of hot or cold air into the filter or cistern, and causing it to

circulate therein, and thus carry off the moisture from the charcoal. *Patent abandoned.*

3451. R. Knox. *Improvements in the manufacture of metallic pens.* Dated December 24, 1862.

In carrying out this invention, the inventor proposes to form the pens either of steel, gold, silver, or other metal or alloys suitable for the purpose, and instead of pointing or nibbing one end of the pen only, as is ordinarily done, he proposes to form a nib at both ends. Thus each end of the pen may be made with fine points, or one point may be fine and the other coarse, or when desired one point may be extra coarse for engrossing. By this invention two pens may be formed of one piece of metal of about the same size as the ordinary pen. *Patent abandoned.*

3452. W. Clark. *Improvements in firearms.* (A communication.) Dated December 26, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3453. C. F. Varley. *Improvements in electric telegraphs.* Dated December 26, 1862.

The first part of this invention consists in employing for electric telegraphy the increment and decrement of electric currents, instead of, as has hitherto been the case, the flow of the current itself. The patentee carries this part of his invention into effect in various modes. Another part of the invention consists in the employment of what he terms a test circuit, formed by induction plates and resistance coils, so adjusted to each other as to produce an artificial line possessing the same amount of retardation as the cable itself. Another part of the invention consists in forming a contact piece of metal in the delicate spring contacts of telegraph instruments as described. *Patent completed.*

3454. E. T. Losesy. *Improvements in the construction of instruments for ascertaining the pressure and the moving force of the atmosphere.* Dated December 26, 1862.

This invention has for its object improvements in instruments for ascertaining the pressure of the atmosphere for increasing altitudes, and for ascertaining the direction and moving force of atmospheric and other currents. The said improvements relate, first, to the instruments for measuring the barometrical pressure of the atmosphere and other gaseous bodies or vapours, the object being thereby to obtain greater accuracy and longer ranges in a smaller and more portable instrument than the aneroid now used for that purpose. One method by which the patentee effects this improvement is by the introduction of a micrometer screw to measure the rise and fall of the vacuum box, in place of the ordinary aneroid mechanism of levers and chains. This micrometer screw is placed immediately over a steel stud, which is attached to the centre of the vaccum box, and projects above it; between this stud and the endof the micrometer screw a pivoted drop piece is placed, and which falls the instant the screw is unturned sufficiently to move the bearing points of the screw stud and drop piece out of contact with each other. By this improvement the amount of atmospheric pressure upon the vacuum box is accurately determined by the rotary motion of the screw, and indicated by a hand in connection therewith travelling round a graduated dial. Secondly, to instruments for measuring the force of horizontal vertical or oblique motions of air or other gaseous bodies from gentle currents to strong gales. One form of this improvement consists of a disc fixed on the end of a lever moving on a pivoted axis, and having a weight on the opposite side to counterpoise the disc and lever. A spiral spring is coiled concentrically with the axis, and attached to it at one end, the other end of the spring being secured to a dial, which in use is turned round to wind up the spring until its strength balances the force of the wind impinging on the disc, and thus enable its force to be read off on the dial. A second scale is placed at the end of the disc for measuring very gentle currents of air. *Patent completed.*

3455. J. Swainson. *Improvements in the manufacture of pill boxes and similar boxes from solid wood, and in the machinery to be employed in the said manufacture.* Dated December 26, 1862.

This invention consists in improvements in the manufacture of pill boxes and similar boxes from solid wood lengths, and in the machinery employed in the said manufacture, by which improvements great saving of wood and labour is effected. In making pill boxes and similar boxes, according to this invention, the patentee cuts the wood into short lengths, the said lengths being somewhat greater than the length of the boxes to be made, and he afterwards turns the exterior of the said lengths to the size required by means of a turning machine commonly called a thread bobbin machine, the said machine also fashioning one end of the wood length for the reception of the box-lid. He next places the said turned lengths in the holder of the machine hereinafter described, and by means of the said machine he bores or cuts out the inside of the wood lengths to the required depth. Pill boxes, or similar boxes, are thus manufactured, and are ready for the reception of the lids, the said lids being made by turning the exterior and boring out the interior of the short wood lengths as described with respect to boxes. *Patent completed.*

3456. W. H. Samson. *Improvements in certain machinery for cultivating land by steam power.* Dated December 27, 1862.

This invention consists -1, in constructing the apparatus used for ploughing as follows:—The plough-frame carries three ploughs, side by side, but a little in advance of each other; these ploughs can be turned so as to be a right or left-handed plough, similar to the Kentish plough; also, the position of the plough cad be changed—for instance, the first plough in advance can be drawn behind, the hindermost plough drawn to the front, the centre one keeping its position. 2, Two traction engines are used when ploughing, one at each side of the field, and opposite to each other, and attached to each engine is an inclined plane upon which the plough mounts as it arrives at either side, and thus withdraws itself from the soil. When entirely clear from the soil, the engine is moved forwards, the width of the plough carrying with it the inclined frame and ploughs; the ploughs are then turned round on the inclined planes, either by means of a turntable constructed thereon, or it is first lifted by a small crane and turned by hand. The position of the mould boards is then changed from right to left, or *vice versa*, as the case may be, and the first plough pushed backwards and the last one forwards, the middle one retaining its position, as described. The plough is then ready to recross the field, when the same operation is repeated. 3, In order to economize steam power as much as possible, the inventor couples the two engines together by means of a chain or rope, which passes round a pulley fixed to, and driven by, the engine from one to the other across the field, so that, when one engine is not drawing the plough, it may, through the means of the chain, assist the other. *Patent abandoned.*

3457. M. F. A. Courtois. *Improvements in wax and other candles and torches.* Dated December 27, 1862.

This invention consists in providing wax, stearine, spermaceti, tallow, or other candles, with a tubular wick or wicks, instead of with the solid wick hitherto made use of in such luminaries, for the purpose of procuring a suitable admission of air to the interior of the flame, and thus insure a better combustion. *Patent abandoned.*

3458. J. and S. Freemantle. *Improvements in apparatus for propelling vessels.* Dated December 27, 1862.

In carrying this invention into effect, the inventor proposes to construct a paddle attached to two arms, the ends of which arms are connected with moveable horizontal beams; the arms and paddles are actuated by means of a crank connected to the engine shaft, and situated on the exterior of the vessel within the paddle-box, a similar paddle with arms, beams, and crank being arranged on the opposite side of the vessel. The revolution of the crank will carry the paddles downwards and backwards in a descending and ascending curve, and will cause them, on leaving the water, to be extended to their foremost position on a level above the water, thereby avoiding contact with the surface of the water. *Patent abandoned.*

3459. J. Petrie. *Improvements in slide valves for steam engines.* Dated December 27, 1862.

The patentee claims—1, opening a portion of the back surfaces of slide valves to the atmosphere, or placing them in communication with the condenser; 2, forming slide valves as cylinders, or portions of cylinders, and imparting an axial motion thereto. *Patent completed.*

3460. M. Ker. *An improvement in wardrobes or other pieces of furniture or fittings, with glass silvered doors or panels used for toilet purposes.* Dated December 29, 1862.

This invention consists in the addition of a looking-glass to a wardrobe or other piece of furniture or fitting, having a glass silvered door or panel, in such manner as that it can be drawn out and adjusted so as to reflect in the glass door or panel the back of any person looking in it. This is effected by cutting the frieze of the cornice over the door or panel, and inserting sliding frames or other extending arrangements with a glass frame hung to them on centres. These frames or extending arrangements when closed will be entirely concealed behind the frieze, and when drawn out will extend the requisite distance behind the observer with the glass frame at the end of them, which can then be adjusted to the proper angle to cast the reflection of the observer into the glass door or panel when he is standing between it and the moveable glass frame. Cords and pulleys can also be applied to the extending apparatus, by means of which it can be drawn out and closed without being touched itself by the hand. The cord can be extended to any convenient part of the wardrobe or fitting, from which the apparatus may then be drawn out or closed. *Patent completed.*

3461. J. G. Taylor. *Improvements in dress fastenings, and in the ornamenting thereof.* Dated December 29, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3462. J. H. Riddell. *Improvements in cast metal or other pipes or tubes for conveying gases, fluids, or vapours, and in the mode of connecting such pipes or tubes.* Dated December 29, 1862.

This invention consists in forming a groove or recess in the face of the flanges the sectional form of which groove may be either the segment of a circle or any other convenient shape, and by preference the patentee forms this groove or recess in the face of the flange in the space between the internal orifice or bore of the pipe, and the holes cast and made in the flange through which the bolts or screws pass are used in connecting the different lengths or pieces of pipe together. These grooves or recesses being formed upon the face of each flange, must be arranged to meet with each other when brought together, forming a grooved channel round the face of each flange; and in connecting these improved pipes together, he places a ring of india rubber, hemp, or other suitable and elastic material in this groove, and draws the flanges together by bolts and nuts or screws, thereby compressing the elastic ring or packing, and forming a joint impervious to gas, water, or steam. *Patent completed.*

3463. J. H. Riddell. *Improvements in stoves.* Dated December 29, 1862.

This invention relates to improvements in stoves usually called hot-air or slow combustion stoves, and consists in an arrangement by which the heated or radiating surfaces of such stoves are so increased as to cause a large volume of air to be rapidly heated to a comparatively low temperature, instead of, as in former arrangements, heating a small volume of air to a high temperature, and which heated air can only be used after being mixed with a large volume of cold air. The patentee carries his invention into effect by forming a fire-box of cast iron or other material, which may be lined with fire-bricks, and which fire-box is connected with one or more chambers, through which the heated products of combustion pass on their way to the chimney or vent, such chambers being fitted with metal or other tubes either in a vertical or sloping position, through which tubes a current of air is constantly and rapidly flowing, and which air becomes heated in its passage, and prepared for warming and ventil[illegible]arches, or large halls or buildings. *Patent compl[illegible]*

3464. A. W. Sleigh. *Rendering or making ships and vessels and floating and shore batteries, or ambulant or stationary defences impenetrable to shot and shell and other missiles and projectiles and war rams.* Dated December 29, 1862.

This invention consists in the employment and use of elasticity and reaction obtained by the mode of arranging, placing in a certain direction, and fixing the hereinafter mentioned materials in the following manner:—The improved method is to construct elastic or reactionary metal plates or timber slabs of any required thickness or extent; this is done by placing between each of those plates or slabs (of equal size, but of much less thickness) a metal plate or timber slab, or several slabs or plates thickly and closely studded with tufts of thin fine fibre of vegetable or metallic or animal production, such as fine springing metal wires, bristles, or whalebone, or a fibre called drafts; those materials may be used singly or combined. *Patent abandoned.*

3465. F. Tolhausen. *The use of petroleum or coal oil as fuel, and also for the machinery and apparatus to be employed for this purpose.* Dated December 29, 1862.

This invention relates to the use of petroleum or coal oil as fuel, more especially for generating steam for operating machinery; also to tanks for containing, and a furnace for burning, the oil; and to apparatus or machinery for conveying the same to the furnaces as rapidly as may be desired. The furnace—which may be of any suitable size and shape, is constructed of ordinary materials. Instead of a grate or bars now used, the bed of the furnace is constructed solid, to prevent the escape of the fluid. This bed may be made either smooth or corrugated. The draught is obtained through a grating in the side or end of the furnace, which admits the air, but confines the flame, and an additional supply of air comes to the flames through pipes terminating within the walls of the furnace. The oil enters the furnace at the bottom, and is at first ignited by surrounding the mouth of the pipe through which it passes with a small quantity of burning coals. A cap may be placed over the furnace for protection, in case the flame should escape through the gratings. Tanks for holding the oil are provided with pipes, which permit the escape of explosive gases, and renders the use of this oil perfectly safe. These tanks are connected with each other, and with a distributing reservoir by pipes of suitable size. A steam or hand pump may be employed to draw the oil from the tanks to a distributing reservoir. From this reservoir, which is situated in a higher plane than the bottom of the furnace, the oil passes into the furnace, the flow being regulated as may be desired by a stop-cock, which is governed by the pressure of steam or by hand. A waste-pipe carries back any surplus that may accumulate in the distributing reservoir to the tanks. *Patent completed.*

3466. G. Haseltine. *Improvements in cartridges, and in the mode of charging small arms and ordnance.* (A communication.) Dated December 29, 1862.

This invention consists in separating the powder or other explosive substance of a cartridge or charge into two or more parts, by means of a disc or discs made of metal, hard wood, or other suitable material. The discs are made to fit closely, thereby forming a complete separation of the explosive material, with the exception of a central perforation through which the fire is communicated from one part to another of the cartridge or charge. When these discs are employed, the separated portions of the charge successively explode, and a perfect ignition of the powder is secured. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated March 27, 1863.

807. J. King, Chadshunt Farm, near Kineton, and T. H. Marshall, Combrooke, Warwick. Improvements in machinery and apparatus for preparing land for seed, and for harrowing land.

Dated June 2, 1863.

1375. G. H. Cottam, St. Pancras Iron Works, Old St. Pancras-road. Improvements in bricks suitable for being used for paving stables and other places.

Dated June 17, 1863.

1519. F. de Wylde, Great College-street, Camden Town. An improved means for the protection and preservation of lead surfaces exposed to the action of water, and for the protection of such surfaces from decomposition by atmospheric action. (A communication.)

1522. A. Samuelson, 28, Cornhill, engineer and steam ship builder. Improvements in apparatus for evaporating liquids.

Dated June 19, 1863.

1540. W. Hicklin, Balls Pond. Improvements in metal screens and sieves for screening and sifting, applicable also to other openwork articles.

Dated June 20, 1863.

1559. W. Clark, 53, Chancery-lane, engineer. Improvements in the treatment of broom for the manufacture of paper pulp. (A communication.)

Dated June 23, 1863.

1578. W. W. Sleigh, London, doctor of medicine. A new method for obtaining motive power.

Dated June 24, 1863.

1592. E. Myers, 2, Millbank-row, civil engineer, and W. R. Williams, meter maker, 35, Lamb's Conduit-street. Improvements in wet gas meters.

Dated June 25, 1863.

1598. C. A. Count de Goddes de Liancourt, 19, Holly-street, Dalston. Improvements in apparatus for the preservation of life from drowning.

Dated July 3, 1863.

1654. W. E. Newton, 66, Chancery-lane, civil engineer, Improvements in the treatment and preservation of of all kinds. (A communication.)

1656. C. Baulch, Bristol, boot manufacturer. Improvements in the manufacture of boots and shoes.

1658. H. Thomas, Birmingham, manufacturer. An improvement or improvements in candle-sticks.

1660. E. Lelios, Threadneedle-street. Improvements in the means of and apparatus for churning.

Dated July 4, 1863.

1666. H. A. Bonneville, 24, Rue du Mount Thabor, Paris. Improvements in steam engines. (A communication.)

1670. J. Oxley, Frome, brickmaker and engineer. Improvements in filtering apparatus.

Dated July 6, 1863.

1672. A. Gower and B. S. Gower, Market Drayton, agricultural engineers. An improved sowing and harrowing machine.

1676. J. McG. Croft, 8, Abbey-road, St. John's Wood, doctor of medicine. Improvements in propellers for propelling vessels.

1680. G. C. Collyer, 152, St. George's-street East, tobacconist. Improvements in the treatment of cut tobacco for its better preservation.

Dated July 7, 1863.

1684. E. Edwards, Birmingham, manufacturer. Improvements in instruments or apparatus to be used in the manufacture of glass finger plates and other articles made of glass, and in kilns for annealing articles made of glass.

1686. J. Orr, Kidderminster, manager. Improvements in weaving piled and other fabrics, and in the machinery or apparatus connected therewith.

1688. W. E. Gedge, 11, Wellington-street, Strand. Improved apparatus for milking. (A communication.)

Dated July 8, 1863.

1692. G. Haseltine, 12, Southampton-buildings, Chancery-lane, civil engineer. Improvements in brick machines. (A communication.)

1694. F. Ely, Totton, Southampton. An improved composition applicable to corn plasters.

1700. R. and L. A. Tallerman, 131, Bishopsgate-street Without. A new method of waterproofing and ventilating boots, shoes, and slippers, for preventing wet and damp feet.

1704. J. Thomas, Battersea, ironfounder. Improvements in treating ores and earths containing iron in order to obtain the metal therefrom.

Dated July 9, 1863.

1708. E. Phillipson and W. Bond, Accrington, overlookers of power looms. Improvements in temples for looms.

1710. P. G. B. Westmacott, Newcastle-upon-Tyne, civil engineer. Improvements in cranes and in dock-gate and other crabs.

1712. P. G. B. Westmacott, Newcastle-upon-Tyne, civil engineer. Improvements in hydraulic engines.

1714. R. Agate, Hornsey, plumber and builder. Improvements in the construction of skylights and rooflights for railway stations, conservatories, and other similar structures.

1716. W. Tent, Birchin-lane, glover and hosier. Improvements in pins or hooks for suspending fabrics, dresses, or parts of dresses, curtains, and other articles of upholstery or apparel.

1718. W. Tasker, Waterloo Iron Works, near Andover, agricultural engineer. Improvements in thrashing machines.

Dated July 10, 1863.

1720. A. R. Johnston, Grove, Yoxford, Suffolk, gentleman. An improved portable fence for sheep and cattle pens or for other enclosures.

1722. J. J. Shedlock, 12, Abingdon-street, Westminster, engineer. Improvements in the construction of soil pits, and in the mode of emptying the same. (A communication.)

1724. W. Clarke, Forest-road, Nottingham, lace manufacturer. Improvements in the manufacture of ornamental lace.

1726. R. Hornsby, jun., J. Bonnall, and W. Astbury, Spitalgate Iron Works, Grantham. Improvements in traction engines, and in apparatus for ploughing and tilling lands by steam and other power, part of which improvements is also applicable to driving or giving motion to machinery.

1728. W. Henderson, Kensington, chemist. Improvements in treating ores and other substances containing iron, in the manufacture of iron, steel, and alloys of iron, and of a purifying and deoxidizing agent therefrom, also in the constructinn of retorts or kilns for treating the said ores and substances.

1730. J. Campbell, Silvertown, Essex, contractor. Improvements in the permanent way of railways, and in supporting the rails thereof.

Dated July 11, 1863.

1734. M. W. Ruthven, 72, Oxford-terrace, Hyde-park, engineer. Improvements in rudders or apparatus for steering vessels.

1736. J. Orr, J. Brinton, and J. Lewis, Kidderminster, carpet manufacturers. Improvements in weaving "chenille" and in the machinery or apparatus connected therewith.

1738. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in cartridges for breech-loading arms. (A communication.)

Dated July 13, 1863.

1740. J. Mortimer, 47, Gresham-street, architect and builder. Improvements in the construction and arrangements of dwelling-houses in combination with the means employed for ventilating the same.

1742. H. Coulter, Liverpool, lamp manufacturer. Improvements in the burners of hydro-carbon and other fluid burning lamps.

1746. R. S. Walker, High-street, Wapping, ship surveyor. Improvements in sheathing or coating iron ships.

Dated July 14, 1863.

-- C. Opperman, King's-road, Peckham, chronometer [illegible]. Improvements in means or apparatus to facilitate the connecting and disconnecting horses and other animals with carriages.

1753. J., T., and F. R. Holmes, Norwich, agricultural engineers. Improvements in thrashing and dressing machines.

1760. J. Davison, Southwick, near Sunderland. Improvements in furnaces for boilers, smelting, and other useful purposes.

1762. W. Wood, Monkhill, near Pontefract. Improvements in "warping" or covering land, bog, or peat, with earth or soil.

1764. W. Roberts, Lylands Twyford, near Winchester, farmer. Improvements in ploughs.

1766. J. Slater, Derby-villas, Park-row, Plaistow, engineer. Improved machinery for compressing bricks, tiles, and other plastic materials.

Dated July 15, 1863.

1768. T. Wimpenny, Holmsfirth, York, manufacturer. Certain improvements in machinery or apparatus for roving and spinning wool, cotton, and other fibrous substances.

1770. W. H. Cheetham, Ashton-under-Lyne, mechanical draughtsman. Improvements in obtaining hydraulic motive power.

1772. P. A. J. Dujardin, 29, Boulevart St. Martin, Paris, physician. Improvements in electric telegraphs.

1774. R. A. Brooman, 166, Fleet-street, patent agent. Improved means of, and apparatus for, reducing charcoal and other friable substances to fine or impalpable powder, particularly applicable to the manufacture of a substitute for lamp black. (A communication.)

Dated July 16, 1863.

1782. H. Elliott, Birmingham, gunmaker. Improvements in breech-loading firearms.

1784. L. R. Bodmer, 2, Thavies-inn, Holborn. The manufacture of a new product from peat and peat tar. (A communication.)

1788. A. Montleart, Mildmay-park, widow, and W. Tent, of Birchin-lane, glover and hosier. An improved mode of attaching hooks to furniture or fabrics for suspending dresses or parts of dresses, fabrics, curtains, and other articles of upholstery or apparatus.

1790. O. Wakefield, 10, Union-place, Lambeth-road, Lambeth. Improvements in cocks or taps.

1792. E. Maw, Leamington. Improvements in the manufacture of pillars, posts, columns, mouldings, and buildings, when corrugated metal is employed, and in machinery used in corrugating, moulding, and shaping metal for such purposes.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, July 28, 1863.

702. F. Hoyos. Stove or firegrate.

704. W. Vernon. Communicating signals or intelligence to or from railway trains.

709. W. G. Eavestaff. Pianofortes.

712. W. H. Atkinson. Studs or fastenings.

713. W. E. Gedge. Framing pictures, looking-glasses, and other objects. (A communication.)

721. W. Donbavand and D. Crichton. Looms.

722. J. Roberts and R. Naylor. Organs, harmoniums, and pianofortes.

728. E. Legris. Thrashing out the seed of flax.

729. T. Oldknow. Construction of jacquards.

731. W. Lorberg. Treatment of rags and obtaining valuable chemical products from the animal fibre therein.

732. A. Morel. Generating carbonic acid.

751. J. Brigham and W. Bickerton. Reaping or mowing machines.

757. E. Hartley, J. Clegg, T. and J. Mellodew. Looms.

758. J. M. Hetherington. Combing cotton and other fibrous materials.

768. H. Cook. Transmitting electric currents and signals for telegraphic purposes. (Partly a communication.)

773. A., J., and J. Topham. Manufacture of ornamental twist lace.

807. J. King and T. H. Marshall. Preparing land for seed.

811. J. Leeming and R. S. Markindale. Carding engines.

819. H. Hughes. Shaping metal and plastic substances.

840. W. West. Working railway signals.

847. E. F. Clarke. Fastening rails for railways.

849. J. Cassell. Distillation of petroleum and other heavy oils.

871. E. T. Hughes. Manufacturing the ornamental tips of parasols, umbrellas, and similar articles. (A communication.)

1035. L. A. J. Bruet. Registering, indicating, and verifying the time and distance passed over by vehicles.

1040. A. Legras. Making ices.

1357. E. T. Hughes. Transmission of motive power. (A communication.)

1375. G. H. Cottam. Paving stables and other places.

1376. D. Wilson and E. A. Cowper. Presses.

1478. G. Davies. Oiling journals or axles. (A communication.)

1648. E. Lloyd. Waterproofing, softening, and preserving all kinds of leather and articles made therefrom.

1690. G. P. Reed. Watches or timekeepers.

1724. W. Clarke. Manufacture of ornamental lace.

1772. P. A. J. Dujardin. Electric telegraphs.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 24, 1863.

248. J. Oglesby, J., W. M., and J. Dickinson.	258. C. P. Stewart and J. Robinson.
249. H. O. Cook and E. G. Terrey.	295. A. Forbes.
251. R. Ward.	296. W. C. Barnes.
254. W. Conisbee.	974. T. A. Weston.
255. S. W. Francis.	1091. E. G. Brewer.

Sealed July 28, 1863.

283. W. E. Gedge.	364. M. Wigzell.
286. T. Bennett.	396. S. Whitaker.
299. W. Clark.	413. J. H. Johnson.
310. J. Mellor.	431. J. Brown.
315. J. J. Hays.	499. J. Clay.
316. L. J. H. Marville.	518. R. Maynard.
324. J. Gill and J. Parkin.	582. E. Habel and E. Suckow.
334. A. Johnston.	714. W. H. Emett.
349. J. Price.	749. G. Coles, J. A. Jaques, and J. A. Fanshawe.
362. T. Hill.	1080. W. Rodger.
367. W. Whitaker and W. Tongue.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1768. E. Hollis.	1804. H. C. Ash.
1770. W. Turner and J. W. Gibson.	1811. L. Kaberry.
1775. R. Hewens.	1823. J. Renshaw.
1803. J. Pilkington.	1887. J. Rives.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1729. C. Amet.	1767. W. Wood.
1742. J. Onions.	2124. P. A. Balestrini.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending July 25, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
3353	1 0	3369	0 4	3378	0 4	3387	0 4	3403	0 4	3414	0 4
3354	3 10	3370	0 4	3379	0 8	3388	1 0	3404	0 6	3415	0 4
3361	0 4	3371	0 4	3380	0 4	3389	0 4	3405	0 4	3418	0 4
3362	0 4	3372	0 8	3381	0 4	3390	0 4	3406	0 4	3419	0 8
3364	0 10	3373	0 4	3382	0 4	3392	0 6	3407	0 4	3420	0 4
3365	0 10	3374	0 10	3383	0 4	3395	0 10	3409	0 6	3423	0 4
3367	1 6	3375	0 8	3385	0 4	3398	0 10	3410	0 4	3424	0 4
3368	0 8	3377	0 4	3386	0 4	3399	0 8	3413	0 4	3425	0 4

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	p ct.
IRON:—					
Welsh Bars, in London	per ton	6 5 0	to	6 15 0	2½
Nail Rods	do	7 0 0		7 5 0	
Hoops	do	8 5 0		8 10 0	
Sheets, single	do	9 5 0		9 15 0	
Staffordshire Bars	do	7 10 0		8 0 0	
Bars, in Wales	do	5 10 0		6 2 6	
Rails	do	5 16 0		6 0 0	net
Foundry Pigs, at Glasg, No 1	do	2 14 0		2 16 0	
Swedish Bars	do	11 10 0		12 0 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		0 0 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	99 0 0		0 0 0	
Hammered Bottoms	do	100 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	101 0 0		0 0 0	
Tough Cake and Ingot	do	92 0 0		0 0 0	
Tile Copper	do	89 0 0		0 0 0	
Best Selected	do	95 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8¼		0 0 8½	
Fine Foreign	per ton	97 0 0		100 0 0	
TIN:—					
English Block	per cwt.	6 2 0		0 0 0	2½
do Bar	do	6 3 0		0 0 0	
do Refined	do	6 8 0		0 0 0	
Banca	do	6 11 0		0 0 0	
Straits	do	6 6 0		6 7 0	
TIN PLATES:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 6	
Second Quality	do	1 7 0		1 7 6	
Coke	do	1 3 0		1 4 0	

TIMBER, duty 1s. per load, drawback 1s.

Teak ... load	£12 0	£13 0	Archangel, yellow	£13 0	£13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
,, yellow pine	3 10	4 10	Finlan	9 0	10 0
St. John, N B., yellow	0 0	0 0	Memel	10 0	15 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
,, birch	3 10	4 10	,, white	9 0	9 10
,, elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderhamn	9 10	10 10
,, fir	2 10	3 10	Christiania, per C., 12ft. by 3 by 9 in.		
Memel fir	3 5	3 10			
Riga	3 0	3 5	Christiania, yellow	21 0	23 0
Swedish	2 10	2 15	Deck Plank Dantzic,		
Masts Quebec red pine	5 0	6 0	per 40 ft. 3 in.	0 14	1 4
,, yellow pine	5 0	6 0	PUMICE STONE pr ton	5 10	9 0
Lathwood Dantzic, fm	5 10	6 10	OILS, &c.		
,, St. Petersburg	8 0	8 10	Seal, pale ... per tun	47 0	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Sperm body	80 0	81 0
			Cod	53 0	53 0
			Whale, Sth Sea, pale	15 0	45 10
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	60 0	0 0
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	47 10	0 0
Yellow pine, per reduced C.			Palm, fine	35 0	0 0
			Linseed	45 0	0 0
Canada, 1st qual.	17	18 0	Rapeseed Eng. pale	45 0	0 0
,, 2nd do.	11 0	12 0	Cotton seed	33 0	34 0

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 7, 1863.

IMPROVED ORDNANCE.

Whichever system of ordnance may be ultimately adopted for fighting the battles of the country—whether the chosen plan be Armstrong's, Lancaster's, Whitworth's, Blakeley's, or Thomas's; whether it be a combination of the best points of each system; or whether (as is most likely) a special build of gun be ultimately used for each particular service—there has certainly been no lack of discussion as to the relative merits of the different guns and their several inventors. Ever since the quondam Newcastle solicitor prevailed over the ordinary coyness of Government officialdom, and received a title, a fortune, and a reputation as a reward for his *ingenuity;* like the "Champion of England," Sir William Armstrong has had to meet the onslaughts of all comers; while the merits of his guns and the originalities of their details have been questioned on all sides by his rival competitors in ordnance improvements. With an appropriateness to the subject delightful to contemplate, a merciless cannonade on paper has raged at intervals for several years, to the bewilderment of the uninitiated and the amusement of a few. Fully prepared, by the law-training of his youth, Sir William Armstrong has always vigorously backed up by his pen the productions of his workshop; Mr. Whitworth has retained a distinguished legal gentleman for the defence of *his* system of artillery; while the gallant Captain Blakeley has conducted his own defence in person. A mere recapitulation of this paper warfare would take up many pages; it may be sufficient to state that no combatant has come off completely victorious. The only feasible plan of ending the contest would appear to be an actual triangular duel, similar to the species of combat advocated by that friend of our youth, Mr. Midshipman Easy; and to the gun and inventor coming out of the ordeal with the least damage, should be adjudged the palm of merit. The ordnance gentlemen, however, have not had all the campaign to themselves; and amidst the roar of artillery, the sharp crack and whizzing bullets of a rifle have been occasionally heard. The instant that any marked feat had been accomplished by any one of the rival artillerists—such as that of the flat-pointed shell by Mr. Whitworth—a concise little note from the veteran Captain Norton would make its appearance in the public prints, suddenly laying the embargo of priority on the merit of all inventions whatsoever in projectile warfare, and a more special and determinate claim to the invention that might be in question.

The inquiries as to relative priority of invention are evidently of no importance to the nation, and rival inventors may well be left to fight out such questions amongst themselves; the relative merits of gun construction, however, are questions of national importance, which cannot be put off to the decision of the hour of trial on a field of battle. Urged by the representations of the press in general, and of this journal in particular, the Government appointed a Select Committee last year to inquire into "the expenditure incurred since the beginning of 1858 on various improved natures of ordnance," and the result is a report, now lying before us—in substance a mere apology of the Government for its shortcomings with regard to the Armstrong gun.

As almost all the outlay incurred during the last five years was on Armstrong guns, the report sets out with a history of the adoption by the Government of this system of ordnance. It thus appears that the then Mr. Armstrong first made half-a-dozen of his guns in 1854 for the Government, and that one of these guns was favourably reported on after an examination by the Ordnance Select Committee. This same gun was re-bored up to a 5-pounder, and in December, 1856, its practice at 1,500 and 2,000 yards was said to be excellent. In the beginning of the year 1858 another gun was tried with success in competition with a service 32-pounder, and in the presence of the Ordnance Select Committee. Two 18-pounder guns were then ordered by Government, and their performances being favourably reported on by Colonel Lefroy, General Peel appointed a Special Committee to fix upon the best rifled gun for field service. It is reported (with what truth we know not) that the previous *Select* Committee—under the Presidency of General Kater, well known for his scientific attainments—found themselves unable to give a favourable report on the Armstrong gun. This latter Committee determined to examine no other guns but those of Armstrong and Whitworth; and as Mr. Whitworth had then no guns of his own construction, nor any particular system of gun, and as he "had only rifled Government blocks of brass and cast-iron," the experiments were almost confined to Mr. Armstrong's system. The Committee thus consider that the adoption of the Armstrong gun by the then Secretary of State for War was fully justified.

A guarantee was then given to Sir W. Armstrong to enable him to expend £12,000 on plant and machinery. In 1859 he made over all his patents to the Government. In order to increase the number of guns to be delivered, the Elswick Company was formed in 1859; and the guarantee was progressively raised from the original amount to £50,000, £60,000, and lastly—by Lord Herbert in October, 1859—to £86,000. Sir W. Armstrong was appointed "Engineer of Rifled Ordnance" in February, 1859, and "Superintendent of the Royal Gun Factory" in November; and having resigned these two posts in February last, and the engagement with the Elswick Company being also terminated two months later, the £86,000 guarantee money have been handed over to the Company, for which only £19,000 has been returned to the Government in plant and stores. During this time, the sum of £1,471,753 1s. 3d. was being spent at Woolwich on Armstrong guns; and with the sums paid, and those still due to the Elswick Company, a grand total of more than two millions and a-half of pounds sterling have been expended on Armstrong ordnance.

The evidence adduced before the Committee is scarcely doubtful as to the results of this enormous expenditure, although the Duke of Cambridge and the Adjutant-General of Artillery are stated to be "perfectly satisfied with the Armstrong field-gun." Colonel Bingham qualified his opinion by the assertion that half the field-guns in the service are "patched up;" in answer to this, Mr. Anderson, of Woolwich, adduces an ingenious theory of progressive improvement in the manufacturing of Armstrong guns. The preponderance of opinion of witnesses is evidently against the Armstrong gun for field-service on account of its liability to damage through its complication; although, on the other hand, it appears to the Committee itself that "the Armstrong field-gun is the best known for field-service." For efficiency against iron plates the old 68-pounder is, on all hands, acknowledged to be immeasurably superior, as is well pointed out in the letter of Admiral Halsted in our present number. Substantially, what is called Armstrong's system of ordnance evidently stands or falls with the contrivances for breech-loading; and the "shunt system," by which Sir W. Armstrong "attempted to have muzzle-loading guns rifled—without mechanically fitting projectiles—is still an experiment."

Each marked stage towards the culmination of this job—the most gigantic specimen of modern times—is rounded off with some impotent excuse. Where was the Lancaster gun when in 1858 only Armstrong's was tried? This report states that the then Committee refused to try any other guns but those of Whitworth and Armstrong, "because it was not expedient to incur the expense;" and in the very next paragraph it is stated that Whitworth had no system at all. Two millions and a half of pounds sterling have thus been spent by the penny wisdom that refused to expend a few hundred more pounds in experiments. Lord Panmure seems to have had some qualms as to the endurance under actual service of Armstrong's complicated breech-loader, and he advised that the guns "should be handed over to the artillery to knock about, and be reported on as to their endurance of work." Lord Derby, however, took the most common sense view of the question, and in a letter to General Peel, in December, 1858, he strongly deprecates "the expediency (in the then infancy of the invention) of pressing for the immediate supply of a large number of guns." At the conclusion of the report, the Committee—although confessedly believing that the Armstrong gun is still the best—advise that all the different systems now before the public may be experimented upon; that scientific men be freely admitted to the trials; and that all the different guns to be tried be manufactured with an equal amount of good workmanship.

In conclusion, we cannot help remarking, that we ourselves have previously anticipated almost all the opinions of the report. In our volume for 1860, pp. 317, 360, 381, and 413, we pointed out the enormous cost of the Armstrong gun; and in other places we have shown up its mechanical structure. We are thus justified in looking upon this report as a triumphant answer to the stricture made by Mr. Baring, in the House of Commons, on our statements in our number for the 1st of March, 1861—for in that article is contained the main substance of the report we have just examined.

THE SUEZ CANAL.

Projects never present themselves in so dangerous a light as when they appear extremely easy of execution. The diplomatist and the financier, the general commanding armies, and the engineer weilding the powers conferred on him by money and science, can equally bear testimony to the truth of our proposition. When an individual or a company, a government or a nation, ardently desire the accomplishment of a scheme, or the gratification of a desire, calm reflection is seldom employed in investigating the importance of the difficulties to be overcome. Obstacles shrink within their due proportions, and are underrated and combated, in a spirit which fails to provide for contingencies, listens with difficulty to the warnings of experience, or the reasonings of science, and but too frequently plunges into a strife from which it comes forth perhaps vic-

torious, after an expenditure of energy, money, labour, and intellect, which renders the dear-bought victory worthless to the victorious. The strife might never have been entered on, possibly, had not the enemy seemed so weak, the obstacles so trifling.

The scheme for uniting the Mediterranean with the Red Sea, is just such a project, which its proposers undertake to conduct to a successful termination, in just such a spirit. The apparent ease of its execution is the very point which renders its accomplishment most unlikely. It seems unreasonable that the people of Europe, with all the vast resources at their command, should permit a wretched barrier of one hundred miles or so of flat sandy desert, to enforce a detour of some thousands of miles on ships proceeding to the East Indies or Polynesia; and the practicability of removing such a hindrance to commerce, appears still more evident when we remember that the Isthmus of Suez is already a valley under water for more than half the distance to be traversed by a ship canal. Lake Menzaleh extends inland, from Port Said on the Mediterranean, more than 30 miles; Lake Ballah, its continuation, nearly 10 more; while Lake Timsah and the Bitter Lakes increase the distance already under water to 70 miles, or thereabouts, leaving apparently about 30 for actual excavation. Such is the state of the question as far as we can gather information from the map; and 30 miles of excavation is such a trifling task, and the advantages to be gained by its execution are so manifest, that we feel no surprise that the work has been entered on with vigour and energy. M. Lesseps is by no means the first proposer of a scheme which promises to open a gate of communication between the West and the East.

The results of an experience extending over many months, and of investigations carried out with a moderate degree of care, have dispelled much of the illusion; and we find that the execution of this work is encumbered with difficulties of the gravest character on every side. Thus the very lakes which were once considered as being so much of the work already accomplished, are in reality amongst the most serious obstacles to be encountered. Too shallow to be available for navigation, they are deep enough to preclude all the ordinary operations of excavating, imperatively dictating a recourse to the tedious and expensive process of dredging, in order to provide a sufficient depth of water to render the proposed canal available for ships of even moderate tonnage. The sinking of a canal for a distance of nearly 20 miles under water, through Lake Menzaleh—even if dredging is not found necessary through the Bitter Lakes—is no slight engineering achievement, however lightly its proposers may be disposed to regard it. This work alone, cannot fail to demand the expenditure of a sum of money which scarcely admits of an approach to accurate estimation when we consider the treacherous nature of the materials to be excavated. The bottom of the lake is generally sand; and the difficulty of forming anything like a well-defined channel, without the removal of ten times the proper quantity of material, requires none of the colouring of imagination to show its importance. The mere opening of such a subaqueous canal, is not perhaps the worst. It is more than probable that it will be necessary to embank it, in order that ships in passing through, may not fall foul of margins rendered invisible by the depth of water above them. When we reflect that this embankment must be formed of sand or loose material, deposited in great part under water, in just the semi-fluid state in which it leaves the bottom of the excavation in the buckets of the dredger, we think no engineer will be rash enough to determine positively the slope at which it will stand, or the quantity to be dredged.

Mr. Hawkshaw's able report to the Egyptian Government on the construction of this canal lies before us. The eminence of Mr. Hawkshaw's professional reputation, entitles his opinions to deep consideration; a consideration, indeed, which might probably set the matter at rest under other circumstances. In the present case, however, singularly enough, such different sentiments are entertained by men of the highest standing as engineers; that the expressed opinion of any one individual, no matter how able he may be, bears too little weight to be of any very great practical value. It is just a case where the multitude of councillors is not wisdom; and agreeing with Mr. Hawkshaw's views in the main, as we do, we still feel inclined to believe that he has underrated every difficulty to be encountered, as well as the probable expense at which they can be overcome. It is true that his report merely glances at the financial department of the undertaking; still, he tacitly admits the truth or probable accuracy of certain estimates which have been laid before him, and which we consider far too low. On this subject, however, it is impossible to speak positively, without folly. It is one of those questions which only future events can decide. The two French engineers, M. Mongel Bey and M. Linant Bey, who prepared the estimates for the International Commissioners, have, it is true, resided a long time in Egypt, but they have had no experience whatever as regards the deep-dredging of the canal at its entrance; just the situation where unforseen events may occasion an enormous outlay.

We do not wish our readers to imagine that we disbelieve in the feasibility of the work. On the contrary, there is not, so far, any evidence before us of the existence of an obstacle which can prevent the canal being finished in a satisfactory manner. We do, however, more than doubt the possibility of bringing the scheme to its proper termination, without an expenditure of money on which no traffic which the canal is likely to enjoy can pay a fair dividend. Fifty years ago, when a great work was proposed, the nation asked, "Is it practicable?" Half a century's experience in engineering works, and the commercial transactions on which they are based, has altered the question to "Will it pay?" and although we do not doubt for a moment that the Suez canal may prove a magnificent triumph of civil engineering, we have little reason to conclude that it will not be a commercial failure as well.

Quitting for the present the monetary consideration of the question, let us examine the works yet to be executed. Not the least important of these is the completion of the canal which is intended to supply the workmen engaged in the desert, with fresh water brought from the Nile near Cairo. The greatest difficulty in carrying on engineering operations in the East is frequently found in the want of water; and the difficulty certainly attains a maximum when many thousands are employed in the midst of an arid desert, under a tropical sun. M. Lesseps' men have been hitherto almost without water, save that brought for their use on the backs of camels. The canal, however, lately opened between Ras-el-Wadé and Timsah, provides a supply for a short time until the dry weather sets in, ere which the directors of the enterprise hope to have it completed from Timsah to Suez, and from Ras-el-Wadé to Cairo. Suez is at present wholly without fresh water, except that brought by railway from Cairo. The total expense of this preliminary work is estimated at £360,000. The work to be executed on the main canal is concisely put before us by Mr. Hawkshaw:—

Beginning at Suez, a channel will be dredged into sufficiently deep water. The mouth of this channel is to terminate to the southward of the entrance to the basin and graving dock, now constructing for the railway and steam packet traffic. The portion to be dredged will average 16½ ft. deep. Between the upper end of this dredged channel and the Bitter Lakes is a distance of 12½ miles, and the canal between these points will be wholly in excavation, varying from 29½ ft. to 55¾ ft. in depth.

The canal will pass through the Bitter Lakes for about 23¾ miles. Between the Bitter Lakes and Lake Timsah the canal will be in excavation for a distance of 8 miles, the depth of the cutting in this length varying from 29½ ft. to 62 ft. It will then pass through Lake Timsah for a distance of 2¾ miles, the excavation of this part averaging about 26 ft deep. At El Guisr, which lies between Lake Timsah and Lake Ballah, a distance of 11½ miles, the canal encounters the highest ground. The depth of the excavation between these two lakes will vary from 29½ ft. to 85 ft. From the south end of Lake Ballah to Lake Menzaleh is a distance 11 miles, and the depth of excavation between these points will average 29½ ft. The canal then passes through Lake Menzaleh, and with small exceptions the ground throughout this lake is below the level of the sea. The distance between the south end of Lake Menzaleh and Port Said is 20 miles, and the depth of excavation will average 24¾ ft. The works at Port Said consist of a basin 875 yards square, and of an eastern and a western stone jetty extending into the sea. The eastern jetty will be 3,609 yds. long from the coast line, and the western jetty 2,515 yds. long, and the distance between the two is to be 437 yds. The channel between these jetties is to be dredged to a depth averaging 11½ ft. below the present surface. The canal between Suez and the Bitter Lakes was originally intended to be 328 ft. wide, and 262½ ft. wide between these lakes and the Mediterranean. The width between the Bitter Lakes and the Mediterranean is now intended to be 190 ft. The reduced width between the Bitter Lakes and Suez is not yet determined upon, but it will probably be 262½ ft. The length of the canal, from sea to sea, will be 90 miles.

Now, it certainly seems at first sight incredible that works such as these, dealing with no materials more obdurate than sand or clay, should require the outlay of nearly £8,000,000. Yet the mere fact that such is the estimate, places in the strongest possible light the immense difficulties to be encountered from the presence of water, the system of labour, and the want, in a secondary degree, of proper facilities for the supply of necessaries. Mr. Hawkshaw wisely admits that even £10,000,000 may be required; and it would be folly to assert that even this sum is sufficient. The dredging of entrances through treacherous sands, and shoals which constantly shift, is in itself a work of the greatest magnitude and uncertainty. Even after the expenditure of this money, and the completion of a navigable channel, the work does not cease. The maintenance of the canal cannot fail to demand the yearly expenditure of a large sum. Inland, there will be little difficulty in keeping the bed clear of sand or deposit, and we are not disposed to agree with Stephenson that the canal will become a stagnant lake. The evaporation from the large surface exposed by the

inland waters; the slight changes of level produced by the tides; will, in combination with moderate dredging, suffice to prevent any inconvenience of this kind. It is on the sea-shore, from sand drifts brought down by the Nile, that the real difficulty is to be expected by the consequent silting up of the entrances. Mr. Hawkshaw seems to regard the danger as trifling; but even if the Nile never brought down a grain of sand, who can foretel the effect which might be produced by a gale in the Mediterranean, on a channel dredged in sand and imperfectly protected? Steam or other vessels, too, instead of stopping at Alexandria, will have to perform a rather dangerous voyage of more than 150 miles ere they can reach Port Said; a risk which will deter many from using the canal.

Commercially speaking, we cannot conceive how the canal can prove othewiser than a failure. In an engineering sense, there is nothing to prevent its success, provided funds are supplied; and of this there can be little doubt, should the French Government once identify itself with the scheme. Its magnitude and importance are well calculated to extend French honour and power in the East; but with such political questions we, as engineers, have nothing to do. In any case, the present system of forced labour, for the employment of which M. Lesseps has once more got the sanction of the Porte, cannot fail to prove to the last degree injurious to Egypt, and its effects will be felt for many years to come, without the prospect of a benefit, as far as the country is concerned, which could make the existence of the system excusable.

THE COINAGE OF 1862.

A return has just been published of the number of coins of all denominations issued from the Mint during the year 1862. Why that return makes its appearance at so late a period in the present year we know not. It is just possible, however, that *red tape* may have had some share in causing the delay. From this tardily printed official document, we gather that from the 1st of January, 1862, to the 31st of December, in the same year, there were coined at Tower-hill 7,886,413 sovereigns, the total weight of which was 2,012,562·126 ounces. No half-sovereigns were struck, and this therefore comprises the total gold coinage of 1862.

Crowns and half-crowns have long since ceased to be coined, and the next denomination of money referred to in the return is the florin. The number of florins pressed into existence during the period named was 594,000, representing a weight of 216,000 oz., and a value equal to £59,400. Of shillings the quantity struck amounted to 954,300, weighing 173,520 oz., and being worth £47,718 sterling. The number of sixpences produced in 1862 amounted in number to 990,000, in weight to 90,000 oz., and in value to £24,750. There appears to have been a comparatively much greater demand for threepenny pieces, for they equal in number 1,160,808, in weight 5,267·73 oz., and in value £14,510 2s. This list comprises the whole of the silver coinage proper of the year, for like crowns and half-crowns the groat appears to have become obsolete. In addition, however, there were struck for circulation in our West Indian Colonies, 319,774 three-halfpenny pieces of the same metal, weighing in all 726·71 oz., and equalling in value £1,998, 11s. 10d.; besides the annual batch of Maundy money, composed of fourpences, twopences, and pence—these latter numbered, in the aggregate, 16,830, weighing 516 oz., and being worth £141 18s.

Of bronze money, the statistics for the year 1862 are much heavier; but in this case the exertions of the Royal Mint have been supplemented to a very considerable extent by the celebrated engineering firm of James Watt and Co., Soho, near Birmingham, who contracted to supply no less than 1,720 tons of pence, half-pence, and farthings. We accordingly find that the number of new pence put into circulation was no less than 50,534,400, weighing 470 tons, and representing £210,560 in value. The half-pence coined amounted to 61,107,200 pieces, the weight of which was 341 tons, and its nominal value £127,306 13s. 4d. Of farthings, there were struck and issued 14,336,000, weighing 40 tons, and being nominally worth £14,933 6s. 8d.

We have deemed it proper to render an exact account of the moneys coined in 1862, because in the *Times* and other journals the coinage returns of the last ten years have been mingled in inextricable confusion, and are, therefore, of no value as regards any particular year. The general summary of the coinage of 1862 stands as follows:—

Gold coins struck.	Silver coins struck.	Bronze coins struck.
7,836,413.	4,035,412.	125,977,600.

The bronze coinage has been going on at a corresponding rate up to the present time, and nearly another hundred millions of pieces have consequently been put into circulation this year.

VENTILATION OF COLLIERIES.

It has long been admitted that theoretically machine ventilation is superior to furnace ventilation, inasmuch as there is something very anomalous in introducing an enormous furnace into a colliery, in which the greatest enemy to be contended with is an inflammable gas of the most destructive character, but in practice it has hitherto been found, that from the great difficulty in obtaining anything like the theoretical quantity of air by a mechanical contrivance, it is preferable to rely upon the furnace as the smaller of two evils. It is only within the last few months that the success achieved at the West Ardsley Colliery has afforded some tangible evidence that coal cutting by machinery can be satisfactorily and economically substituted for hand labour, and it is now stated that at the same colliery a system of mechanical ventilation is in operation which promises equally good results. The West Ardsley ventilator is the invention of Messrs. Ridley and Jones, and may be briefly described as a modification of some of the more approved forms of centrifugal pumps; such modifications, however, being of so important a nature that no difficulty is found in passing 100,000 cubic feet of air per minute with a comparatively small apparatus, propelled by no more than a 15-horse power steam-engine. The top of the upcast shaft is closed from the external air, and placed in direct communication with the centre of the apparatus itself, the opening between the shaft and apparatus being of the full size of the shaft itself, and so constructed as not to interfere with the passage of the air.

The apparatus consists of a series of spiral chambers, which rotate upon an axis carried in suitable bearings. The spiral chambers are thus produced:—The periphery of the apparatus is not cylindrical, but is formed with openings, by preference four, in planes radiating from the centre of the apparatus. The circumference of the apparatus is closed, except at these openings, by four curved plates, if there be four opening, or outlets, each plate springing from the inner end of one opening to the outer end of the next. The apparatus when in use is caused to rotate with considerable velocity in such a direction that a partial vacuum shall be produced in the spiral chambers, by which means the air is drawn from the upcast shaft into the apparatus, and escapes by the several outlets. It is found in practice that the apparatus works most efficiently in a vertical position, but it is obvious that it may also be placed horizontally by arranging the centre of the apparatus over the upcast shaft, and closing the opposite side; the position of the axle and bearings being necessarily suitably varied.

The dimensions of the apparatus, which must be published in order to enable an opinion of the efficiency of the machine to be formed, are:—Diameter from [illegible] point of two opposite chambers in feet; distance from centre of axis to inner end of chamber in feet; size of central openings to shaft, one on each side, in feet; width of periphery in feet; width of nearest axis in feet; total weight of apparatus in cwts.; and the number of revolutions per minute to produce a current of 100,000 cubic feet per minute. The extent of workings in the colliery at which the apparatus is applied must also be made known, and also the length of time that the apparatus has been in continued daily use, without requiring any repair or attention whatever.—*Mining Journal.*

TRIAL OF ROBERTS' STEAM FIRE-ENGINE "PRINCESS OF WALES."

On Friday evening, the 31st ult., a trial took place of this engine (which had previously been highly commended at the late Crystal Palace Trials) at Millwall, in the presence of one of the engineers of the East Indian Railway, Mr. Edinger, of the East London Waterworks, Lieutenant Becker (Hodges' Fire Brigade), Messrs. E. Field, C.E., F. Wise, C.E., D. Siebe, C.E., and a large party of scientific gentlemen.

The fire was laid in the ordinary manner without any turpentine, tallow, or naptha, and in 2m. 45s. from lighting the fire, everything being perfectly cold, the steam pressure was 5lb. on square inch; in 6m. 30s. = 10lb.; in 7m. 10s. = 15lb.; in 7m. 40s. = 20lb.; in 8m. 15s. = 25lb.; in 8m. 30s. = 30lb.; in 8m. 55s. = 35lb.; in 9m. 11s. = 40lb.; in 9m. 25s. = 45lb.; in 9m. 42s. = 50lb.; in 9m. 55s. = 55lb.; in 10m. 5s. = 60lb.; in 10m. 46s. = 65lb.; in 10m. 28s. = 70lb.: in 10m. 37s. = 75lb.; in 10m. 50s. = 80lb.; in 10m. 56s. = 85lb.; in 11m. = 90lb.; in 11m. 10s. = 95 lb.; in 11m. 15s. = 100lb.; in 11m. 22s. = 105lb.; in 11m. 27s. = 110lb.; in 11m. 35s. = 115lb.; in 11m. 40s. = 120lb., at which pressure the engine was set in motion, and drawn from the yard to the plug where the hose, &c., were attached, and in 17m. 17s. from the fire having been lighted, the engine was throwing a good stream through a 1in. nozzle.

The engine threw streams varying from 1-64th of an inch in diameter up to 1¼ in. diameter, with water pressures varying from 55lb. on the inch up to 95lb., and the steam in the boiler varying from 80lb. to 120lb. The various trials gave great satisfaction to all present, and the engine worked well and steadily. The time, &c., were carefully noted by Mr. Chas. F. T. Young, C.E. At the conclusion of the steam-engine trial, some of the new patent hand-pumps and engines of Mr. Roberts, made for the East Indian Railway, were tried with very satisfactory results.

CONGRESS OF MECHANICAL ENGINEERS, LIVERPOOL.

The annual provincial meeting of the members of the Institution of Mechanical Engineers commenced on Tuesday, in the Concert Room, St. George's Hall, Liverpool. The meeting was numerously attended, and the chair was occupied by Mr. William Clay, in the absence of Mr. Robert Napier, of Glasgow, the President, who was detained at Buxton on account of bad health. Among those present were Messrs. H. C. Beloe, Thomas Duncan, John A. Tinne, — Beloe, jun., Bright, J. Carlis[illegible] J. Hay, J. Vernon, Horman, Plumb[illegible] ham, &c. &c.

The first Paper, which was read [illegible] was "On the Construction of Ir[illegible] John Vernon, of [illegible] Sons, of this tow[illegible] culties which a[illegible] as a material f[illegible] to show the [illegible] ing out that [illegible] cheapness, [illegible] cargo by [illegible] strength [illegible] iron has [illegible] constru[illegible] applied [illegible] once a[illegible] out h[illegible] The I[illegible] ment[illegible] const[illegible]

to be registered A 1 at Lloyd's for twelve years, or for twenty years on the books of the Liverpool Underwriters' Association. The various details of construction for the different portions of the ship were clearly shown by numerous large and distinctly drawn diagrams. The "Great Britain" was referred to as an illustration of the strength and durability of iron ships, which had been exposed to the strain of being a stranded vessel for nearly twelve months in Dundrum Bay without having sustained any material damage, which it was stated could not possibly have been sustained by a wood-built ship. Reference was also made at considerable length to the iron-built screw collier ship "Anne Vernon," which, from its construction, is adapted to receive water as ballast, in water-tight compartments in the lower portion, by which the water can be retained as ballast when the vessel has no cargo, or pumped out when cargo is but on board. Bourne's Indian River Train was also explained at considerable length. These, it was stated, had not turned out quite so satisfactory as had been expected. The question of masts, yards, and rigging being made of iron or steel, by which a large saving of weight, amounting, in a 1,200-ton ship, to about 17 tons if steel were used, by which a considerable saving in the quantity of ballast carried may be effected.

A considerable amount of discussion followed the reading of this Paper, in which most of the speakers alluded in terms of approbation to the painstaking and intelligence with which the subject was treated, and of the amount of information which had been conveyed. The thanks of the meeting were cordially voted to Mr. Vernon.

The second Paper was "On the Effects of Surface Condensers on Steam Boilers," by Mr. James Jack, of Liverpool. It was read by the Secretary. The Paper referred at considerable length to the effect of using salt water in boilers, by which an incrustation of the boilers was produced, whereby the power of transmitting heat was greatly impaired. This incrustation, it was shown, would be in a great degree got rid of by the use of distilled water. The use of this kind of water, however, had been found to cause considerable chemical action on the surface of the metal of the boilers, by which it was corroded and pitted, particularly near the points where the heat was most directly brought in contact with the boiler.

A lengthy conversation ensued, in the course of which it was stated by several of the members that it is highly desirable to ascertain with accuracy what is the immediate cause of this destructive action, with a view to discover what metal is most suitable for the construction of surface condensers. Thanks were voted to Mr. Jack for his interesting Paper.

The third Paper was "On the Mechanical Features of the Liverpool Waterworks," by Mr. Thomas Duncan, of Liverpool. This Paper gave a detailed account of the nature of the waterworks at Rivington and its neighbourhood. The gathering ground of the water extended over about 10,000 acres, the water from which is retained in several reservoirs. These reservoirs, when full, are calculated to contain 3,000,000,000 gallons. The water is passed through filter beds, six in number. From the filter beds the water passes into the pure-water tanks, and thence by cast-iron pipes, with a break at a a principal reservoir at Prescot, and from that to the different subsidiary reservoirs in Liverpool and its neighbourhood. The Paper further described the various apparatus applied at different points for regulating the supply throughout the town. It also detailed the extent and mode of working the old system of wells, by which the water was previously supplied to the town; and likewise explained the mode in which the supply of water is distributed in the case of fires, which it explained to be generally on the gravitation principle, engines being but rarely used.—Thanks were voted to Mr. Duncan for his valuable Paper.

The members of the Institution then proceeded to the Prince's Landing Stage, where they went on board the steam tender "Satellite," and steamed up the river to the Herculaneum Dock, where they landed, and were conducted to the Mersey Steel and Iron Works. Here a sumptuous collation was served to about 200 of the members of the Institution, Mr. Clay presiding. Mr. S. Lloyd, one of the ex-Presidents of the institution, proposed "The health of Mr. Clay," and in the name of the members thanked that gentleman and his partners for the manner in which they had been treated. The company proceeded to view the works, and inspect the many and interesting operations which were in progress. In the first instance, they visited the extensive fitting shop, in which they witnessed the planing and turning of the stem of the "Agincourt," after having been forged and bent. In the fitting shop the visitors also saw and inspected with much interest some extensive apparatus for cutting and turning. Their attention was also attracted by the stupendous "Horsfall gun" and the "Prince Alfred gun." They also inspected a specimen of Clay's patent breech-loading field-piece, which was in the shop. From the fitting shop the party proceeded to the "forge," where they witnessed the operation of one of the numerous steam hammers with which the establishment is so extensively provided. The one referred to was an 8-ton hammer, falling through a space of 6 ft. Their attention was next directed to the operations for the erection of another and very large steam hammer, the preparations for which are very far advanced. When completed, this will be the largest steam hammer in the kingdom. Some idea of its magnitude and power may be formed from the annexed details:—The anvil block, or portion on which the anvil rests, is a solid casting which weighs no less than 62 tons of iron. The hammer will weigh 14 tons, with a fall of 10 ft, by which a blow of almost inconceivable force will be obtained. From the forge the party passed to the rolling mills, and witnessed some of the vast operations which are carried on there. The mill for rolling "armour plates," although sufficiently advanced to be in motion, was not so far completed as to enable them to roll any of the armour plates.

The second sitting was opened on Wednesday morning, at ten o'clock, Mr. William Clay, of the Mersey Steel and Iron Works, President of the Local Committee, again occupying the chair.

The first Paper read was "On the Mechanical Ventilation and Warming of St. George's Hall," by Mr. William Mackenzie. The Paper minutely described the system of ventilation invented by the late Dr. David Boswell Reid, who originated the ventilating and heating apparatus by which the building is regulated in its ventilation and temperature, and which was fitted up in its leading features under the immediate superintendence of Dr. Reid, St. George's Hall being the only building in which that system has been completely carried out. In practically carrying out that system several improvements naturally suggested themselves. Conspicuous among the leading features of this system of ventilation were the introduction of means by which draughts are altogether avoided, or so regulated as to be completely under control. This is accomplished by bringing the whole supply of air into one chamber, in which it may be modified in temperature to suit any desired purpose. Preparation is also made for securing a certain amount of humidity, by bringing it in contact with moisture, so as to keep the air in a condition at all times suited to the convenience of those who are assembled in the building. The Paper was profusely illustrated by well-executed diagrams.—After this Paper had been read some discussion took place, in the course of which it was stated by several members that the ventilating system of St. George's Hall is, taken all in all, the most perfect of any building in the kingdom. The thanks of the meeting were cordially awarded to Mr. Mackenzie for the Paper which he had supplied.

The second Paper was "On Machinery for the Manufacture of Plate Glass," by Mr. George H. Daglish, of St. Helen's. It, like the other Papers, was read by the Secretary, and copiously illustrated by diagrams. The Paper, after briefly alluding to the general processes and materials employed in the manufacture of glass, described the recent improvements which have been introduced in the manufacture, and then at considerable length described the machinery by which plate glass, after being cast and annealed, is polished and regulated. It was stated that, in the process of grinding and polishing, about 40 per cent. of the whole material is wasted. The polishing apparatus used at the Ravenshead Plate Glass Works, at St. Helen's, was stated to be capable of preparing and finishing from 1,200 to 1,500 square feet per week.—In course of the discussion which ensued on the reading of the Paper, it was shown that the purest colour of the glass, of which several specimens were shown, was made from French sand.—At the conclusion of the discussion, the thanks of the meeting were voted to Mr. Daglish for the Paper which had been read.

The third Paper was a "Description of the New Iron Works at Grosmont," in the Cleveland iron district, about seven miles from Whitby. This is a hotblast works. In each furnace the apparatus is sufficient to blow 7,000 cubic feet of highly-heated air per hour through the tubes by which the furnaces are kept in blast. The Paper was very technical and minute in its details, and a considerable amount of discussion took place in reference to several of the points alluded to.—At the conclusion of the discussion, a vote of thanks was passed to Mr. Coulthard, the author, and thanks were also most cordially voted to Mr. Clay for his conduct in the chair.

Soon after one o'clock the members embarked on board the steamer "Satellite," placed at their disposal by Mr. C. MacIver, and proceeded to the Canada Dock, where they inspected the 100-foot gates, the swing bridge, and a capstan, moved by hydraulic power. They went on board the "Asia" and the "Australasian," and were conducted over the works of the British and North American Steamship Company by Mr. MacIver. Reembarking, the next visit was to the shipbuilding yard and ironworks of the Messrs. Laird. The party was met by Mr. John Laird, M.P., who was accompanied by Mr. Whitworth, the inventor of the rifle which bears his name. Her Majesty's armour-plated ship "Agincourt," the powerful steam ram recently launched, a similar one on the stocks, and other vessels in course of construction, were inspected with much interest, as also were the various machinery departments. There was shown in action the hydraulic press, of immense power, by which the armour plates (made at the Mersey Steel and Ironworks) are bent into the required shape to fit a ship's side. After leaving the works of the Messrs. Laird, the visitors landed at the Woodside stage, and thence made an inspection of the Birkenhead Docks, the chain-testing machine belonging to the Mersey Docks and Harbour Board, the great float and the 100-foot gates, and the Messrs. Bibby's copperworks. After this they returned in the "Satellite" to Liverpool.

ENGLISH ARMOUR-PLATES AND AMERICAN IRON-CLADS.

The following letter appeared in the *Daily News*, of July 31, 1863:—

Sir,—Though discussions in Parliament have now for a season ceased, the following facts and inferences, bearing on the state and character of our artillery and armour-fleet at the time of its rising, may yet be of interest to some of your readers, or even of use for grave reflection during the recess, should you deem them worth insertion in your columns.

On the premises of the Iron Ship-building Company, at Blackwall, may be seen near the landing-place where the "Minotaur" is building, an armour-plate erected on its edge, with an inscription beneath it. The plate is, as usual, 4½ inches thick, and now but half its original length. It was made on the premises for the "Royal Oak," and was casually taken last summer from a lot of about 40 similar ones to be tested at Portsmouth by the 68-pounders of the "Excellent's" gun-boat "Stork," being fixed for the purpose on the side of the "Sultan," a worn-out line-of-battle ship, with a timber scantling of 22 inches. Select shot, both of cast and wrought iron, were fired at right angles against it from a distance of only 50 yards with 22 lb. charges of powder, the fullest service charge being 16 lb. only, and by very careful measurement the following are the effects produced under these extreme conditions. The cast-iron shot went to pieces as usual, leaving a crater 8 in. in diameter like itself, and 2¼ in. deep. The wrought-iron shot, still entire, after entering the plate expanded to a diameter of 9 in., and has thus imbedded itself firmly into the face of the plate, like the setting of a jewel; it projects 3¼ in., and has flattened 2¼ in. Each shot has produced a bulge at the rear of the plate; that of the cast-iron protrudes 2½ in. like the depth of its crater in front; that of the wrought-iron protrudes 3¼ in. At the apex of each bulge are open radiating cracks, not wide, not extensive, nor connected, but varying, and how deep could not be measured; but, besides these, neither in front nor rear are there either cracks or other indications of any injury to the metal, even between the two shot-marks, which are less than 8 in. apart.

The solid-shot smooth-bore 68-pounder of 95 cwt., the extreme and exceptional powers of which in powder, shot, and distance, are thus practically to be seen stamped upon the armour plate at Blackwall, is the most destructive gun which either the land or sea service of England possesses; and when the writer was first informed of the above limit to its powers by the party who thus put them to proof, it was added, in reply to a direct question, that not a splinter of any consideration was produced by these exceptional shots inside the ship—so complete is the protection afforded by such plates against

such guns, even within the sides of an old dried-up hulk.

Now, the first practical inference to be drawn from these facts, on this side of the water, seems to be this:—Assuming the timber scantling of the "Gloire" to be no thicker nor sounder than that of the "Sultan," and French 4½ in. armour plates to be equal to British, then, so far as regards the power of British guns by sea or land to stop her, that redoubtable exemplar of modern naval power, or any or all of her full-armoured consorts, may enter Portsmouth Harbour at option, and having there wrought her wicked will, may again retire with scarcely more apprehension of fatal casualty or serious injury than if going in and out of Cherbourg. Of course, the harbour, like the Thames, might be blocked, or "butting," or boarding, or fire-rafts, or torpedoes, or stinkpots, or other means, might be employed for destruction or capture in so insolent a case; but strictly confining the contest to the power of artillery alone, as it exists in the British services, then such casual damage only as could be effected by firing into the ports of a frigate 200 yards off, and covered with smoke, would be the limit of injury to be inflicted through the mailed sides of the intruder, even if the guns were already manned in expectation of the visit; Portsmouth serving specially to exemplify this pleasing hypothesis, as none of its batteries could command the destruction of such a frigate by firing down through her unarmoured decks. And yet it is undoubtedly true that the equally low forts of Charleston victoriously repulsed, and even sunk one of the assailant Federal iron-clads from a distance stated as not less than 900 yards. Let us see the reason why.

In an Admiralty blue-book report (No. 737, of 1850), may be seen the complete drawings and detail account of firing 32-pounder and hollow 8-inch shot from a range of 400 yards at a riveted mass of 14 iron plates 6 in. thick in all, bolted on a timber scantling 2 ft. thick, like that at an 80-gun ship's lower deck, and of the practical destruction of this mass even by guns of such low power. This experiment, made from the "Excellent," in 1842, and in character and result more than once recently repeated, was ordered in consequence of reports from America that effective protection from heavy artillery had been obtained at certain trials of the same sort there; and the adoption of armour-plating of similar construction for all but one of the assailant iron-clads at Charleston, seems to show how far more satisfied our Federal friends must have been, at least up to the time of their repulse, with their own mode of putting such combinations to proof, than we were with ours. For instance—

The "Keokuk," which was sunk, is described to have had her fixed turrets built of ordinary ¼-inch plating, on the frames of an ordinary iron steamer; this was surrounded by ⅝ bar iron, 4 in. wide, placed on edge in the intermediate 1½-inch spaces, filled in with pine, and the whole clothed with five layers of ⅝ plates. The wood and iron combination of her turrets was thus 7⅝ in. thick in all, and that of the vessel herself could hardly have been more.

The "Passaic," described as an improved "Monitor," and the type of six of her Charleston consorts, was protected, apparently turrets and all, by a riveted mass of eleven ⅝ plates, or 6⅞ in. thick in all.

The "New Ironsides," the alone exception, no known description of which has, I believe, reached this country, seems to be an armour-ship of the European broadside type; but from the accounts of the action she appears to have undergone no test whatever of her powers either way.

Thus, if we even allow the same 2 ft. of timber beneath the armour of these iron-clads, as in our own experiment of 1842—and we have no notice that there was any timber—the thickness of the riveted mass practically differs so little in the two cases that the drawings in the above blue-book may safely be taken to represent the type of destruction inflicted on eight of the assailants by the guns of Charleston, assuming them to have been no heavier than those then in use by the "Excellent"; while the powerlessness of our now heaviest service gun against the solid 4½-inch Blackwall plate, proves the practical difference between the European and American systems of constructing ship's armour in quite sufficient contrast to account for the paradox which sent us to seek for "its reason why."

But here it is necessary to prevent the serious misconstruction that, because solid plates such as that at Blackwall protect, where protected at all, the sides of our own armour-ships, therefore any one of them, without distinction, and with equal impunity from guns not commanding her decks, might be sent to return at Cherbourg the supposed visit of the "Gloire" to Portsmouth; or even that our whole number, as now completing, could for a like reason be sent to force such forts as those of Charleston. For however naturally it may seem to have been intended to convey such inference from what has been stated, that which now follows will sufficiently show it to be erroneous in itself, and not consistent with a sound professional judgment in him who should sanction it. For instance—throughout all other navies it is now known that the "Warrior's" foremast marks out for aim a target no less than 81 ft. long; and her mizenmast another no less than 96 ft. long; being a length in all of 177 ft. from her water-line up to her hammock-rail on each broadside exposed to an enemy's fire, which has no protection at all, and where the men and guns may therefore be taken to have been already stripped of all armour, whether by foe or friend, before the first shot of an action is fired. The extent of surface thus exposed is covered for the greater part, where the men on the gun-deck fight, with no more than a single ⅝ plate of iron; and as no practical addition is made to the resistance of such plates by that detached 2 in. lining of wood, which only gives a flush surface for paint inside the ship, there is little doubt that this fighting portion of the structure would, if it were tried, be penetrated by a steel bolt from the ordinary Whitworth rifle. Fourteen inches of combustible teak protect the upper-deck guns throughout; and the now well-known accident to the "Defence" has shown that the ⅞-plating which alone covers the above length of hull from below the level of the main deck down to the water's edge is destructible by any blow such as that of a bower anchor swinging when "a-cock-bill" from a few feet out of the perpendicular. These unarmoured parts are armed with one-third, or 14 out of the whole 40 guns, requiring, on the usual rough estimate 140 men to fight them; and as the mainmast equally marks out the central 26-gun battery, 208 ft. long, where ship, guns, and men are completely protected with plates of the Blackwall build, no enemy, whether from ship or shore, could desire distinctions more clear, even above all the smoke of action, as to what portions of such an antagonist he should and he should not concentrate his fire upon. He also specially knows that all which is vulnerable in the steerage gear and screw—the motive and directing powers—is contained within the thin sides of that aftermost 96 ft. box-target.

These characteristics as accurately describe the "Black Prince" as the "Warrior." In their now altered sister, "Achilles," they apply to the upper deck only, her ten unarmoured main-deck guns being altogether removed, and the hull itself being plated from below the water-line upwards throughout the 81 ft. afore and the 96 ft. abaft the central 26-gun battery, as high as the level of the main-deck platform. What a pity that a few steps further in the same wise direction have not made the "Achilles" our one complete and satisfactory specimen of a broadside armour-ship. The "Defence" and "Resistance" are in fighting features precisely as the "Warrior" on a smaller scale, their masts equally performing the office for an enemy of marking off their two unarmed parts from their central armoured one, which, as before, protects but two-thirds, or 12 out of their whole 18 guns, each. The same office is again performed by the masts of the "Hector" and "Valiant," but with the improvement that their entire main-deck batteries of 32 guns each are plated, leaving exposed at each end about 40 feet of hull below the main-deck platform to the waterline, a reverse variety of the plan of "Achilles." It is thus seen that no enemy from ship or shore need reserve his fire as at Charleston until the approach of such ships within 1,000 yards; but with a modified exception in "Achilles," that each of them presents a large well-distinguished surface, armed and unarmed, weaker than wood to resist the impact of shot, and liable to fatal destruction from as far as any sort of missile can deliver on it a blow equal to that of her own anchor when its surge from the gunboat broke in the bow of the "Defence."

The yet unlaunched "Minotaur," "Agincourt," and "Northumberland," armoured throughout, would present at Cherbourg sides as impenetrable to the British 68-pounders as the "Gloire" at Portsmouth; but aside from the moot question of whether our nearest neighbours do or do not possess artillery more destructive than our own, it is certain that Charleston was defended by modern guns of far greater power, both rifled and smooth-bore. If, therefore, we assume as a standard of the heaviest future artillery—and many will find this too moderate—the same destructive force in solid shot, spherical or conical, as was temporarily exhibited by the 12-ton smooth-bore gun when fired at the "Warrior" target in April and May, 1862, we shall find that the three above-named ships, though armoured throughout, could not maintain a contest at close quarters against such guns; but that against such guns at equally close quarters all seven of the first named ships could successfully resist, as far as regards their armoured portions—a paradox which will again be fully accounted for by the following "reason why."

The above gun, now doubly defunct, when used as aforsaid against the "Warrior" target, was fired from 200 yards with charges of 50lb. of powder behind solid round shot of 156 lb., none of the three shot thus fired producing any serious effect on the inner skin of iron representing the ship as distinct from her armour, but all of them more or less plugging the clean apertures by which they entered through the plates into the backing, and on taking the target to pieces it was ascertained of the shot which entered deepest that it had penetrated behind the plate but 13 inches, leaving five inches of the backing between it and the ship proper into which in the words of the report, "no fragment of the shot had forced its way." But on the 7th of July following, the same gun, under all the same circumstances, sent two shot out of three, right through an equally faithful target of the "Minotaur" and her two sisters the fourth failing to follow suit only because the gun itself burst in firing it; and the details of this trial, as given in the report of the Royal Artillery Institution, are summed up thus:—"From the result of this experiment it is plain that the powers of resistance of a structure such as the "Warrior," are superior to those of a vessel constructed on the plan proposed for the "Minotaur." The additional inch of iron in the thickness of the plate is clearly no compensation for the reduction of nine inches, or half the thickness, of teak backing."

This recognized "result" was then officially followed up by overtures to the builders of the three ships to restore the 18 in. of backing, in which case they must have proved more complete and satisfactory armour ships than even the "Achilles" if fully altered; but the expense, and doubtless the unavoidable exposure of the alteration, decided on their completion as first begun, viz., not with the successful 4½ in. plates over 18 in. of backing, as in the "Warrior" and six first vessels; but with 5½ in. plates over only 9 in. of backing—a now proved inferiority, which cannot be disregarded, should these otherwise noble ships come under fire of any guns of equal penetrative force with that of the above 12-ton smooth-bore, and all the more to be regretted because a similar comparative trial to detect error could have cost the country no more had it been made before, instead of many months after, the closing of the contracts for these ships.

All the ten above-named are armour-ships of iron; the "Royal Oak" and four others, with 32-gun batteries each, and hulls completely mailed, except on upper decks, are armour ships of wood—English "Gloires," with sides equally penetrable or impenetrable as their French exemplar under similar circumstances by similar guns. Here no representative target has yet told us what are their real resisting powers, positive or comparative, when tested as the armour combinations of the "Warrior" and "Minotaur" have been by the above 12-ton representative of modern artillery force in solid shot. Yet they constitute the most compact portion of our armour fleet, and together mount more armoured guns than any other section of it capable of acting together. But while there seems some subtle temptation to strain for an increase of these ships, with their yet unknown powers of resistance even against heavy round shot, their material will be seen to render them peculiarly destructible by those explosive rifled projectiles which up to a recent date all armour-ship warfare seemed likely to be exempt from. For instance—

In November last the whole question of the powers of resistance by European armour-ships against modern artillery assumed entirely new features before Mr. Whitworth's successful experiments with shells. The "Warrior" target, when clothed with only 4½-in. plates, had, as we have seen, successfully resisted complete penetration by the solid shot of the 12-ton smooth-bore at 200 yards, and afterwards was pierced for the first time by the similar 22-ton Horsfall gun, firing a solid round shot of 280 lb. with 74 lb. of powder from the same range. But in November last a "Warrior" target clothed with 5-in. plates was equally pierced completely through by a shell of 130 lb. with 27 lb. of

powder from Whitworth's $7\frac{1}{2}$ ton gun as a distance of 800 yards, and at 600 yards his $3\frac{1}{2}$ ton gun firing a 70 lb. shell with but 12 lb. powder, penetrated the $4\frac{1}{2}$ plate and entire backing of the same target as far as, but not through, the iron skin of the ship; these results showing incontestably that, whenever we may be permitted to have them, guns of this description of a perfectly manageable weight for broadside armament may be effectually used with shells against armour-ships, protected even with Blackwall plates. And the revolution thus effected is no less remarkable than generally unexpected, because the shells require no fuses, and in respect to temper are superior in penetrative qualities to solid shot of the same material.

These proofs go to show that both the "Warrior" and "Minotaur" mode of armour can no longer protect against this complete restoration of effective shell fire, to be no doubt developed still more formidably; but as armour-ships of iron, they possess an extent of security against such missiles from which the "Gloire" and "Royal Oak," armour-ships of wood, of whatever rank, are from the nature of their material debarred. There is before me a copy of the official drawing, made when the November target was taken to pieces, of the effects on its inner structure of Mr. Whitworth's shells. That drawing shows not only how effectively the iron skin of the ship proper has limited inside the range of destructive explosion, but the angle at which the armour-plate itself is shown to have been blasted away around the interior of each aperture directly points to the actual extent of woodwork behind the plate, which must have been more or less shattered or destroyed but for its support and compression under the powerful system of bolting between the inside iron skin and the outside armour. In the target in question, as in all armour-ships of iron, this woodwork behind the armour is only its backing, and if with the plate itself it were entirely blasted off by shell explosion, a sound and strong ship of iron might still remain. But the woodwork behind the plates of an armour-ship of wood is not backing only, it is essentially the timber of the ship, the sole strength of her fabric, having no support but from itself, and with no incombustible inner lining; and to destroy and shatter it with shells is, *pro tanto*, to shatter and destroy the ship herself and those within her—probably to burn her as at Sinope—as effectually as in the days when outer plankings of wood did their best to protect from shell-fire the similar wooden timbers beyond them. Is it, then, well and wise towards the country—can it be just and true towards its navy—to meet this complete restoration of destructive shell-fire by increasing our force (?) of such armour-ships as are most exposed to be destroyed by it, in preference to those which are least? When 5-inch armour can already be pierced like 5-inch cheese, is it not a time to increase rather than abolish the protection of that inner skin of iron which, even at its present $\frac{5}{8}$ thickness, is seen by all who will look very sensibly to limit the splintering and destruction of these iron-plate shells? But if there be real honest doubt, why not remove it openly? Why not take warning before too late again from the "Minotaur" case? The armour-ship of iron has had her target before these shells, and the big shot, too. Try the same fire on an equal target of the "Royal Oak," and let open, not secret results, as in former times, decide this revived strife about the safest material for our future armour fleet.

Whether the walls of Cherbourg or Charleston be as yet defended by armour-plate shells is probably not fully known here; but it is quite certain that they will be, as in due time may be those of Portsmouth, too, as well as all armour fleets; and in that day it seems likely that ships between themselves, and in intercourse with fortresses, will, according to relative force, observe towards each other much the same amount of respect as in past times; speed in almost all cases constituting a chief standard of relative war merit. But of the plans now before us as yet to be developed, the cupola ship bids higher than any other, as against both ships and forts, to become the type of future maritime strength. With unapproached facility for carrying and working the heaviest practicable guns, able to be burthened with the heaviest reasonable armour, freed for equipment with highest powers of speed by steam and sail, and with promise of superior seaboat qualities, the cupola ship, as a true British invention, claims every support and encouragement the country can extend to her talented inventor in his arduous struggle for her speedy, complete, and successful development as the future floating symbol of our naval power.

The difficulty of dealing with the theme of this letter at all, without testing the soundness of each main link of that complicated and scarce connected chain we have now been four years weaving, with so much cheap self-gratulation, and such substantial expense, past, present, and future, may, I trust, be accepted in apology for its length by yourself and readers.

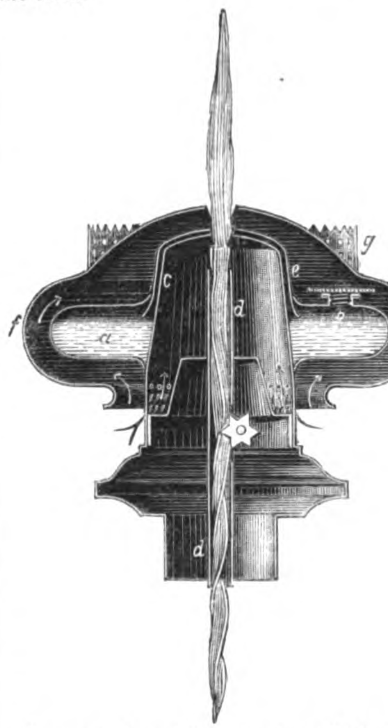
I am, &c.,
E. Pellew Halsted, Rear-Admiral.

SCHOMBURG AND BALDAMUS'S IMPROVEMENTS IN LAMPS.

The following invention for improvements in lamps has been patented by Messrs. R. Schomburg and A. Baldamus, of Lorrimore-road, Surrey.

The invention consists in leading the vapour from water to all kinds of oils while burning in lamps, whereby combustion is rendered more perfect and the purity of the light increased. The heat generated when the wick is lighted causes the vapour of water to ascend in a hollow cone or conical chamber round the wick tube and issue in contact with the flame about or above the point of its generation. A thin film of vapour rises from the water vessel up a narrow channel or space between two cones or conical caps with apertures through or between which the flame passes. The water vessel is by preference surrounded by another vessel or chamber, between which a passage is formed through which air passes to the flame.

The accompanying drawing is a longitudinal section of so much of a lamp as is necessary for showing the method of carrying the invention into effect.



a is a vessel containing water, which is admitted through the opening *b*, closed by a screwed or other stopper; *c* is a hollow cone or conical chamber surrounding the wick tube *d*; *e* is an inverted cup-shaped or conical vessel placed over the cone *c* in such manner as to leave a narrow channel or space between it and the cone *c*; *f* is an outer case through which air passes to the outside of the flame. The heat from the flame causes vapour from the water in the vessel *a* to rise through the space between the conical caps *c* and *e* to the flame. Atmospheric air is led to the flame through the spaces *c* and *f*; *g* is the support or holder for the chimney. The other parts of the lamp are of the ordinary construction. Instead of the vapour from water being generated by the flame of the lamp, it may be otherwise generated and conveyed to the flame.

NEWTON'S IMPROVEMENTS IN TRANSMITTING POWER.

Letters Patent have been granted to Mr. A. V. Newton, of 66, Chancery-lane, for the invention of improved apparatus for the transmission of power.

This invention relates mainly to a novel arrangement or combination of gearing applicable to the transmission of power to steering, hoisting, or hauling apparatus. The invention may be described as consisting in the arrangement of two cog wheels with a different or equal number of teeth—one being firmly secured to the drum of a steering, hoisting, or hauling apparatus, and the other being stationary; or when the apparatus is to be used for hoisting or other purposes, the

FIG. I.

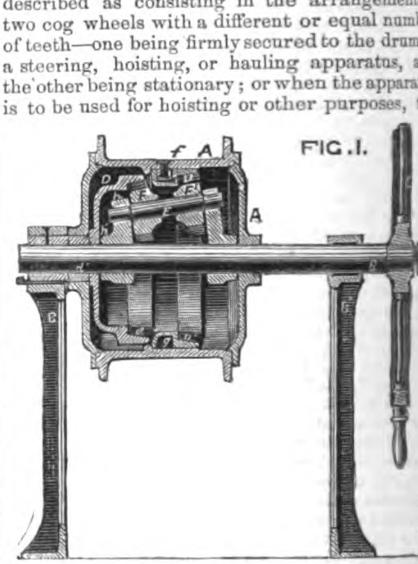


FIG. 2.

former wheel being stationary and the latter secured to the drum or drum shaft. In combination with these cog wheels are pinions, having an equal or different number of teeth, and attached to a tumbling shaft, which is carried round the drum shaft in such a manner that on rotating the wheel or drum shaft by the combined action of the two pinions on the tumbling shaft and the differential wheels, a slow rotary motion is imparted to the drum (or to the drum shaft when used for hoisting or other purposes). The power applied to the wheel shaft or to the tumbling shaft is multiplied in proportion to the number of teeth of the gear wheel which is fast to the drum, divided by the difference between the number of teeth of the said wheel and that of the stationary wheel; or if the number of teeth of these cog wheels is equal, divided by the difference

between the number of teeth of the two pinions on the tumbling shaft, it being understood that a difference must exist either between the number of teeth of the cog wheels, or of the pinions, or both.

The invention is represented in the drawing as applied to steering apparatus: fig. 1 being a longitudinal central section of the apparatus, and fig. 2 a transverse vertical section of the same.

A represents the drum on which is wound the rope or chain that governs the position of the rudder when the apparatus is used for steering, or from which the load is suspended, when the apparatus is used for hoisting or hauling. This drum (which may be made of cast iron, wood, or any other suitable material) turns loosely on the shaft B, to which the steering wheel C is firmly attached, and which has its bearings in standards B^1. The drum A is hollow, and a cog wheel D with an internal gear d is firmly secured in the interior of the drum. This cog wheel is provided with a hub which projects through the side of the drum, and which is firmly keyed to one of the standards B_1, being bored out to fit the shaft B, and turned off on its outside to form a good bearing for the drum, so that the drum rotates while the cog wheel D remains stationary. D^1 is an internal gear or a rim provided with teeth on its inside and turned off, so that it fits nicely into the drum. It is prevented from rotating independent of the drum by three (more or less) stops, which are secured to the inner surface of the drum by screws, and which project into a groove turned into the rim D^1. This groove is provided with three (more or less) abutments. If the spaces between the abutments and stops where left empty, the drum impelled by the sudden motions of the rudder would fly in either direction, bringing the stops alternately in contact with the abutments on either side. Or if the rim D^1 were rigidly attached to the drum, the sudden motions of the rudder would cause an equally sudden jar of the cogs, rendering them liable to get broken or out of order. To avoid these disadvantages, the spaces between the abutments and stops are filled out with india rubber or other elastic material, and by these means the cogs of the gear wheels are saved from injury. E is the tumbling shaft which has its bearings in arms h projecting from hubs that are firmly keyed to the shaft B. This shaft carries two pinions—the pinion F to gear into the cog wheel D, and the pinion F^1 to gear into the cog wheel D^1. Instead of one tumbling shaft with pinions, two or more such shafts, each with its own pair of pinions, might be employed, as indicated in fig. 2 of the drawing. The operation is as follows:—If the cog wheel D has 36 cogs, and the cog wheel D^1 40 cogs, and the two pinions F, F_1, which are of equal diameter, each 12 cogs, and if the shaft B is now rotated until the tumbling shaft has made one complete revolution round the centre of the shaft B, the pinion F by the action of the cog wheel D will make 36-12ths = 3 complete revolutions, causing the pinion F^1 to make the same number of revolutions, or to progress 36 teeth by the time the tumbling shaft has returned to its original position. The drum therefore is compelled to rotate for the distance of 40 — 36 = 4 teeth for each revolution of the tumbling shaft, or to make 1-10th of a revolution for each revolution of the steering wheel. It is obvious that by decreasing or increasing the difference between the number of teeth of the two wheels D, D^1, the motion of the drum for each revolution of the shaft B can be decreased or increased at pleasure, and in the same ratio the power exerted by the man at the steering wheel can be increased or decreased as much as may be desired. A strain exerted on the drum will have little effect on the shaft B, because the pinions F, F^1, have the same diameters, and the entire strain will be sustained by the stationary wheel D.

The same apparatus may be used with equal advantage for hoisting or other purposes, and the wheels D, D^1, may be made with an external gear, in which case the the wheel D^1 would be secured to the shaft B, and the tumbling shaft would have its bearings in the heads of the drum.

UTILIZATION OF SEWAGE.

IT is well known (says Liebig, in a letter recently written by him to some of the London papers,) that the manufacture of artificial manure is based on the doctrine that the nourishment of all cultivated plants consists of inorganic or mineral substances. Manure consisting of organic substances can be produced by the agriculturist only. The farmer produces farmyard manure; the manufacturer, on the other hand, mineral manure, with which he furnishes the farmer with those efficient elements wanting in stable dung. The most important fabrication is that of superphosphate of lime. The question of immediate importance to be decided is the value to the farmer of the sewerage used, and it is easy to find this by comparing the sewage matter with guano, the effect and price of which are known to the farmer, and of whose value he is able to judge. The problem to be solved is, therefore, how much of the efficient elements of guano a farmer can convey to his field in a ton of sewage; or how many gallons of sewer water are equivalent to a cwt. of guano. Regarding the component parts of the best sorts of guano we have certain and reliable data—those relating to sewer water are less so; but we might long ago have been fully informed of its average contents if, last year, at the mouth of each sewer in London, five gallons of water had been collected morning and evening every day during the week, and at the end of the 7th day one gallon of the collected seventy gallons subjected to chemical analysis. It would be necessary, of course, to determine as nearly as possible the quantity of water discharged at each sewer. Lacking more certain data, I take Professors Way's analysis of sewer water, which this most reliable chemist made at the request of the General Board of Health.

I reckon that Peruvian guano contains 14 per cent. of nitrogen (= 17 ammonia), 12 per cent. phosphoric acid, and 6-10ths per cent. of potash. Professor Way analyzed the water of two sewers, one in Dorset-square and the other in Barrett's-court, and found in one gallon of sewer water—

	Barrett's-court.		Dorset-square.
Ammonia	41·18 grs.	......	17·96 grs.
Phosphoric acid	10·44 „	......	4·17 „
Potash	44·18 „	......	3·33 „

The difference in the contents of the two sewers is very great, for the first contains twenty-nine more ammonia and phosphoric acid, and fifteen times as much potash as the other. According to the analyses of Dr. Hoffman, Frankland, and others, I am of opinion that I may take the contents of the Dorset-square sewer water as the averge standard for my calculation. From the above figures it results that 101 tons (22,200 gallons) of this sewer water contains the same amount of phosphoric acid, more than three times as much ammonia, and sixteen times as much potash, as one cwt. of the best Peruvian guano.

It will be observed that there is a great difference in the proportion of phosphoric acid to ammonia in guano and sewer water. In guano this proportion is 6 parts of phosphoric acid to 8½ parts of ammonia; in sewer water this proportion is 6 parts of phosphoric acid to 26 parts of ammonia. The reason of this disproportion in the amount of phosphoric acid and ammonia in sewer water is at once perceived, if we remember that the bones of the slaughtered animals do not find their way into the sewers. These bones are, however, the manuring matter in which phosphoric acid abounds; and their component parts, let it be well understood, must be given back to the fields if it be intended that the soil shall retain its fertility. Potash and ammonia are, according to their prices, far more costly manures than phosphates, and in many cases quite as necessary for the field as this latter can be. Potash and ammonia are wholly inefficient and useless without the presence of phosphoric acid; but with the addition of phosphates, they become efficient and valuable. The manufacturer of manure is not able to supply potash and ammonia to the farmer in sufficient quantity, and at an available price; but it is easy for him to collect the bones and make up the deficiency of phosphate by drawing it from natural sources.

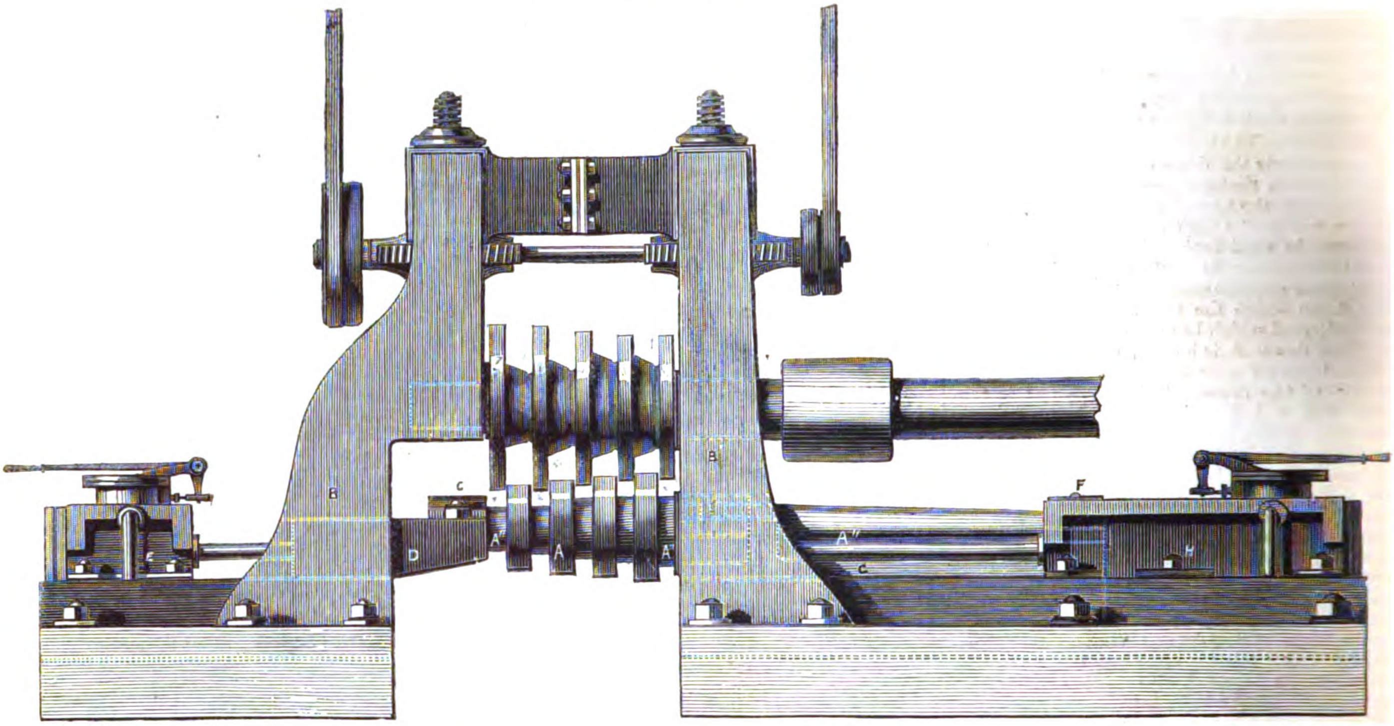
It will, I think, be now perceptible, what connection there is between the manufacture of superphosphate and the utilization of sewage. If the farmer add to the sewer water the phosphate which is wanting in it, the efficiency of the water will be increased. Thus, 101 tons of sewer water, to which 120 lb. of superphosphate have been added, are equivalent to 305 lb. of Peruvian guano, and the value of the sewer water will be 305 lb. of guano, at £13 12s. 6d. a ton, 498 pence; from this subtract the price of 120 lb. of superphosphate, at £5 5s., 76 pence; which gives the value of 101 tons sewer water, 422 pence, or 4d. for one ton. It must not be forgotten, that sewerage without the addition of phosphate is of much less value, because, if the farmer were to give the soil, in sewerage, as much phosphoric acid as is in 305 lb. guano, he would have to apply 305 tons of sewer water (instead of 101 tons), which would give the value of 1½d. per ton. I am of opinion that the proportion of ammonia which is brought into the soil by dressing the land with Peruvian guano, is much too large and even noxious for future crops; but this does not belong to the present question.

From exact calculation of the liquid and solid voidings of London (the detail of which would be out of place here), we may conclude that 42 tons of ammonia, 10 tons of phosphoric acid, and 7½ tons of potash, find their way into the London sewers daily. These 42 tons of ammonia are contained in 247 tons of guano, the 10 tons of phosphoric acid in 83·3 tons guano; thus, 163·7 tons remain in which the phosphoric acid is wanting; or, what is the same thing, if to the sewerage obtained daily from London 100 tons of superphosphate of lime (at 20 per cent. of phosphoric acid) be added, the value of the daily voidings of the metropolis, or the sewage of London, is made equivalent to 247 tons Peruvian guano; or, by the addition yearly of 36,500 tons of superphosphate, we may acquire the value of 90,155 tons guano, at £13 12s. 6d. = £1,226,364. Deduct the price of 36,500 tons of superphosphate, at £55 s. = £191,628, and we have £1,036,736 as the money value of the sewage. To this should still be added the worth of the potash in the sewer water. Potash is the manure which the farmer obtains with the most difficulty; it is that element, too, which renders his stable dung (the amount of phosphoric acid and ammonia being the same) of greater value and efficacy. In 247 tons of guano about 1½ tons of potash are contained; but every day 7½ tons are obtained in the sewer water, which gives a surplus of 6 tons, corresponding to 11 tons of sulphate of potash, giving yearly 4,015 tons, which, at £18 per ton, shows a money value of £72,270. Add this to the sum above given, and we have, as real money value of the London sewerage, £1,109,006.

The surplus potash won from the sewer water daily corresponds to the amount contained in 866 tons of stable dung. Without the addition of the superphospate the value of the sewerage of London would only be £304,045. In the calculation of the value of sewer water there is one factor doubtful—viz., the absolute amount of phosphoric acid, ammonia, and potash which a ton of the said water contains. It might probably be found that some sewer water was richer, another more diluted or poorer in these component parts, but in the relative proportion I do not think that any very great difference would be found. Sewer water will, in the average, contain more potash than I have allowed for, inasmuch as the fluid voidings of horses are to be added, which increase the amount of potash. We may assume that one-third of the population of Great Britain, or ten millions of men, live on corn and agricultural produce imported from abroad. For this a pretty considerable number of millions of pounds sterling must be paid, besides another pretty considerable number which must be earned by the nation, in order to pay for the purchase of manures to produce the food of the remaining 20,000,000 of inhabitant. Many superficial observers appeal to statistics, which appear to show that much of the land yields one-third more than it did in the last century, and this is not they say a sign of decrease of fertility; but they forget at what cost their larger crops are obtained, and that they are due to an enormous expense of capital for the purchase of foreign manures. It is a sign of a poor or an exhausted soil, if, in order to get high returns, we have to add large quantities of manure from without; a rich or fertile soil does not require such an addition.

The employment of sewerage in agriculture could make it possible to bring large tracts of land into cultivation which hitherto, owing to the expense of tillage, had been laid waste and neglected; others, too, might be so improved as to make the crops remunerative, and good yields would bring in a larger revenue. The vast capital which hitherto has left the country to pay for corn and manure might be kept at home and employed for other purposes. Should the present state of trade and industry not materially change, a great part of this capital would be devoted to agriculture, and the natural consequence would be, that the i[illegible]ing population would find ample occupati[illegible]ndry. Great

LONGRIDGE'S ROLLING MACHINERY.

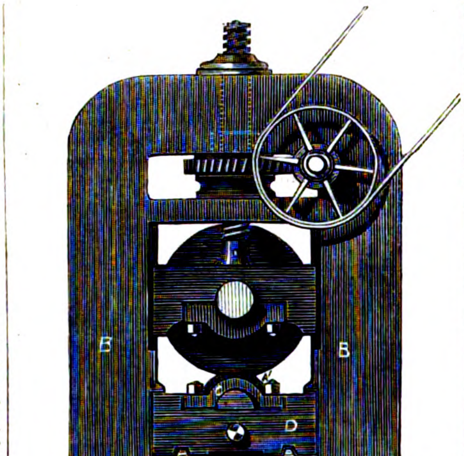


Britain is large enough, if we take the arable surface of the land, to produce all the corn and meat necessary for its inhabitants. It is neither fantastic nor ridiculous to believe that, without purchasing foreign manure, and by a judicious utilization of the sewage of towns and villages, England would be able to dispense with the importation of food from abroad. For her it would be a blessing if the application of capital to agriculture were found sufficiently profitable to awaken speculation in this direction, so that the industrial population, manufacturers, and tradesmen might devote themselves to the production of bread and meat.

LONGRIDGE'S ROLLING MACHINERY.

Letters Patent have been granted to Mr. W. S. Longridge for the invention of improvements in apparatus for rolling metals, railway tyres, boiler plates, &c., by which the patentee is enabled to roll such tyres, or sheets, or plates, or other sections of metal in the form of hoops or rings. The upper roll of his improved machinery is mounted in the manner usual in rolling machinery, and the lower roll is mounted in such manner that when the tyres, hoops, or rings are passed into or removed from the machines they are passed between the end of the lower roll and the side frame which carries the bearing of the roll.

Thus, one end A^1 of the lower roll A when in its working position, as shown, does not reach into or up to the side frame or standard B of the machine, but an intermediate or open space is left between the end of the roll and the side frame or standard sufficient to allow the bloom for the tyre, hoop, or ring to be passed between them, and inserted between the upper and the lower rolls and to be removed therefrom. The bearing C which carries this end of the lower roll is mounted upon a carriage D sliding longitudinally into or upon the frame B to and from the lower roll A, so that when it is traversed backwards from the roll the intermediate or open space referred to between the roll and the frame is left free for the passage of the bloom, tyre, hoop, or ring into or from between the rolls, as required, and when the bearing carriage is traversed in the opposite direction, or towards the lower roll, it projects inwards between the frames and receives the journal or end A^1 of the lower roll, thus forming its bearing and support, and upon which it revolves; E is an hydraulic cylinder, secured to the foundation framing of the machine for the



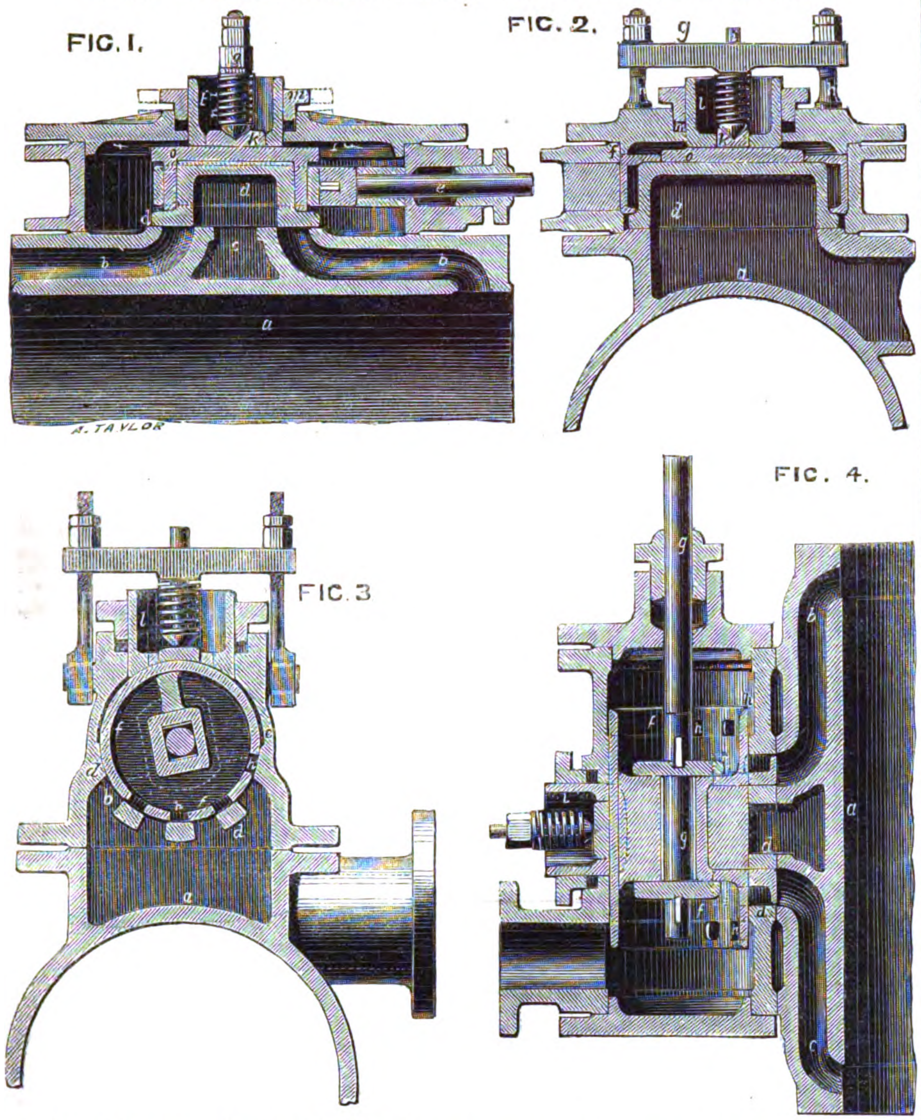
purpose of traversing the bearing carriage D. Any other means may be used for the purpose of traversing the bearing carriage instead of the hydraulic cylinder, as convenient. When a tyre, hoop, or ring is to be rolled or operated upon in the machine the action is thus:—The upper roll is raised, the bearing carriage is then traversed back from the lower roll, so as to leave the intermediate space between the end of the roll and the frame open and free for the passage of the bloom or tyre into or between the rolls, the bloom or tyre is then introduced, the bearing carriage is then traversed back to the roll; the upper roll is then brought down, and the rolling proceeds in the usual manner of such operations. This being finished, the upper roll is again raised sufficiently, the bearing carriage is traversed back, and the tyre, hoop, or ring removed from the machine. When hoops or rings of greater width than the interval of space between the end of the lower roll and the frame above referred to are required, the machine is so constructed that the lower roll itself is traversed longitudinally to any extent requisite to allow the passing of the hoops or rings into and from between the rolls. The end A^{11} of the lower roll is supported by the bearings, E, F, upon the sliding carriage G which is traversed by the hydraulic cylinder H, thus the lower roll is traversed, as required, for the introduction and the withdrawal of the article under operation in the machine.

DEFRIES' LAMPS.

The following improvements in street lamps have been recently patented by Mr. C. Defries, of Houndsditch.

This invention principally regards those lamps termed street lamps, and its object is to obtain a better light for passengers than is obtainable from street lamps as at present constructed. Further, the proposed lamp will be less costly in its original manufacture, and of very trifling expense in repairs. In the City of London, and elsewhere, it has become the practice to furnish each lamp with a regulator, and this is placed within the lamp under the burner. From the bulk of this regulator, and the opacity of the framing or sashes of the lamp, the light from the burner is greatly obstructed. The inventor proposes to form a lamp of a top and bottom (or upper and lower) frame, connected in the centre by a pipe which runs from the top of the lamp-post (being secured thereto); on the top of this pipe are radii or arms supporting both the lower frame at its top and the upper frame which rests on the said top. The frame in which the glasses of the lower part of the lamp rest is supported on the capital of the lamp-post by scroll work. On the capital of the lamp-post is placed the regulator, and as this is usually of less diameter than the said capital, and the burners are to be considerably above it, no light will be intercepted thereby. Small branches for the burners are let into the pipe which, as aforesaid, passes through the centre of the lamp. The inventor makes channels or grooves, in which are received the upper and lower edges of as many strips or pieces of glass as the formation of the lamp may render desirable; these he places in the channels so as to form top, sides, and bottom. The centre pipe is either made a reflector, or coated with any material. The top of the lamp rests on the bottom part, and is to be lifted therefrom when lighting, or it may be hinged to the framing, and turned back for that purpose. A lamp is thus produced without any framing or sash bars between the top and bottom of the lower part or body of the lamp, all being glass, with the ex-

PETRIE'S IMPROVEMENTS IN SLIDE VALVES FOR STEAM-ENGINES.



ception of the narrow framing (which holds the glass) immediately above the regulator or stop-cock, no hindrance is given to the light. In case of breakage of any of the glass, it is only necessary to take out the pieces with the fingers, and in the same way insert a new strip or piece, which drops at once into position, no putty or other fixing being required, and the glass having room for expansion or contraction consequent upon atmospheric changes.

PETRIE'S IMPROVEMENTS IN SLIDE VALVES FOR STEAM-ENGINES.

The following invention for improvements in slide valves has been recently patented by Mr. T. Petrie, of Rochdale, Lancashire.

The invention consists, firstly, in a method of removing steam pressure from slide valves, for which purpose the inventor opens a portion of their back surfaces to the atmosphere, or upon the same principle places such back surfaces in communication with the condenser or similar apparatus. In the accompanying drawing this part of the invention is shown by figs. 1 and 2. A portion of the cylinder is at *a*, the ports at *b*, and the exhaust passage at *c*. The slide valve, of ordinary construction, is shown at *d*, worked by means of the rod *e* in the usual manner. At the front of the valve box *f* there is a cross bar *g*, mounted upon screw studs *h*, and carrying loosely a pin *i*, which abuts at its inward end againsta cross piece *k*, carried by a hollow piston *l*. This piston passes through the face of the valve-box, and through a stuffing-box *m* formed thereon. Between the cross bar *g* and a shoulder upon the pin *i* is a spring *n*, which therefore tends to force the said pin forward and with it the piston *l*, until its inward end presses against a plate *o*, attached to and moving with the slide valve *d*. The plate *o* in the direction of the slide valve's motion is of such a length, that during the opening and closing of the ports the inside aperture of the piston *l* will always be closed, and an escape of steam from the valve-box thus prevented. It will be seen that as the piston is open to the atmosphere, it represents a given surface upon the slide valve from which the steam pressure is removed, and that this removal may be increased or diminished as desired by varying the area of the said piston. In order to secure at all times a sufficient pressure to keep the slide valve to its seat, the spring *n* is employed, and its elastic force may be regulated by tightening or loosening the nuts of the cross bar *g*.

The next part of this invention is shown at figs. 3 and 4, in which a portion of the cylinder is at *a*, and the ports at *b*, *c*. The valve seat is at *d*, and instead of being flat as for ordinary slide valves, it is a portion of a cylinder formed in the valve-box *e*. The slide valve is at *f*, cylindrical in form, so as to fit the seat *d*, and it receives the usual sliding motion by means of the rod *g*. Each of the ports *b*, *c*, consists of several (in this instance, four) separate passages, and there is a corresponding number of passages *h* formed in the cylinder, constituting the slide valve. Supposing the passages *h* (fig. 3) to be situate opposite to those shown at *b* (and which constitute a port) be coincident, then the upward and downward motion will alternately open and close the ports as in ordinary slide valves; but if during this reciprocating motion a turning of the rod *g* be effected, then the passages *h* will be brought opposite to the solid parts of the seat, as seen in fig. 3, and the steam will be shut off. This turning of the shaft may be effected by any ordinary mechanism connected to a moving part of the engine, and adapted to suit different constructions of engines or situations, or it may be caused to take place sooner or later through the medium of the governor, as is well understood in applying cut-off motions. The apertures *h* in the slide valve for the port *c* are situate between those which belong to the port *b*, so as to obtain the necessary alternate action.

In the drawing is shown the first part of the invention combined with that just described, excepting that in this instance the piston *l* is formed at its inward part so as to correspond to the curve of the cylindrical slide valve.

PAY OF ENGINEER OFFICERS WHEN IN CHARGE OF ENGINES.

The following circular has been issued by the Admiralty:—

Admiralty, June 18, 1863.

With reference to the regulations at present governing the rates of pay of engineers in charge of engines, under which engineers and assistant engineers in charge are granted one shilling per diem extra, no allowance being payable to chief engineers or to engineers for special charge: My Lords Commissioners of the Admiralty are pleased to direct, by the authority of Her Majesty's Order in Council, dated the 11th inst., that the following rates of extra allowances shall in future be paid to engineers of every grade, when in charge of engines of ships in commission, in lieu of those at present established:—

	Rate per day. s.	d.
When in charge of engines under 200-horse power	1	0
When in charge of engines of 200-horse power, and under 400-horse power	1	6
When in charge of engines of 400-horse power and under 700-horse power	2	0
When in charge of engines of 700-horse power and upwards	3	0

Engineers and assistant engineers, in charge of engines of ships not in commission, to receive as at present 1s. per diem.

By command of their Lordships,
C. Paget.

ON THE FINANCIAL ENCOURAGEMENT BY GUARANTEES OF COLONIAL AND FOREIGN RAILWAYS.

Mr. Bidder, in taking part in a discussion on a Paper on the Scinde Railway, read at the Institution of Civil Engineers, by Mr. John Brunton, M.I.C.E., spoke as follows:—

Looking, on the one hand, at the vast extent of India, and its prodigious population, and on the other, at the very few effective ports, and comparing it with Great Britain, with only a fifth of the population, but with ports on every part of the coast, the importance of the question was at once evident; in fact, he believed that no outlay, however large, would be misapplied which went towards perfecting the ports of India. Mr. Brooks had correctly stated that the only two good ports were Bombay and Kurrachee; Madras was no port at all, and Calcutta was as bad as it could be; yet those were, at present, the only outlets for the vast trade of India.

The question to which he wished to direct attention was far more important than that of the engineering, or of the ports. It was as to the mode in which Indian railways were, in future, to be carried out and worked, and he believed that on that question would depend the future extension and success of railways in India. There was one great satisfaction in looking at the map of India, that the lines at present executed and in progress were in the right direction. The lines from Calcutta and Kurrachee, meeting at Delhi, with their eventual connection at Bombay, must be the permanent backbone of the railway system in that country; and if that system were completed, and if nothing more remained to be done, it would be unnecessary

for him now to advert to the peculiar conditions which attached to the construction of Indian railways, and the difficulties under which they had been carried out. When the railways in India were projected, three financial systems were open for consideration. First, their being carried out by private enterprise—that broke down at once, because the capitalists of England were disinclined to take them up on their own account. Secondly, the method of subvention, which never was, he believed, seriously entertained. Thirdly, there was the system of guarantee, which had been ultimately adopted. Before further adverting to that system, he would remark, with a view to prevent misconstruction of what he was about to say, that he had no strictures to make upon the mode in which it had been administered, whatever imperfections might attach to the system itself. That it had been carried out with any degree of success was, he believed, greatly owing to the endeavours of all parties to make it work. Every one had gone, more or less, beyond strict routine, otherwise the railway system in India must long ago have collapsed. At present, the railways in India were entirely carried out on a system, by which the Government guaranteed a certain rate of interest on the outlay. The result was, that the Government was liable for the interest on all the outlay, so that, in fact, they had to look to the receipts of the railways for the repayment of the liabilities thus incurred. The Government, therefore, felt it necessary to overlook the whole lof this outlay, and for that purpose there was estab ished a system of supervision, permeating into the greatest minutiæ. The consequence was that all individual energy and all independent activity were restrained; and, as he said before, unless the authorities, particularly the official directors, so far as his experience went, had applied themselves very much to the oiling of the machinery, he thought it must very soon have stopped altogether. He trusted, therefore, that his remarks would be taken as applied to the system, and not to individuals, or to bodies of individuals; for he was bound to say that India was a field which brought out, in every respect, and in a most peculiar manner, the energies of the Anglo-Saxon race.

The whole political system of England, from the beginning of the establishment of her rule in India to the present time, had been, theoretically, the worst possible; and that glorious empire had been established by the individual energy of those who represented this country in India. This remark applied peculiarly to those who had been connected with the railways of India. The amount of work which the directors, particularly the chairmen, had gone through, was prodigious; the amount of correspondence was marvellous, and that they should have had the patience to drag through it, was, he was bound to say, perfectly astonishing. The question arose, whether it was desirable that the system should be changed, and whether so much yet remained to be done in India as to make it desirable that the reconsideration of the system of making and working railways in India should be seriously entertained. With regard to the extension of railways in India, the backbone of the system was still far from being completed; the line from Umritsir to Delhi, a length of 300 miles, remained yet to be accomplished. If the Indus had been a deep, quiet canal, the carrying of the railway system along that valley might for some years have been postponed; but the Indus was perhaps the worst specimen of inland navigation that could be conceived, and, as the author had stated, the channels of navigation were 570 miles in length, as against 470 miles of direct route. Mr. Bidder had very carefully considered the question of the Indus flotilla, and he was every day more satisfied, that the necessity of occupying the valley of the Indus with a railway was becoming more urgent. Even in regard, therefore, to that backbone, there was about a thousand miles of railway yet to be constructed. The question then arose as to the best mode in which it could be carried out, and the best system of working it, when completed.

He had already stated that the Government of India was liable for a given rate of interest upon the whole outlay for the railways; there was, therefore, a distinct interest in the receipts, and the same minute supervision was exercised in the working as in the construction of the line. Before any comparatively unimportant step could be taken in the Punjaub, sanction had to be obtained from the Lieutenant-Governor of the Province, which he could not grant without reference to the Governor-General of India; and, in a similar way, the Commissioner of Scinde was powerless without the sanction of the Governor of Bombay. Then again requisitions, for manufactured railway material and for workmen, sanctioned by the officials he had referred to, had to be reviewed, commented upon, and endorsed by the Secretary of State for India in Council in London, before the most urgent want could be supplied. As regarded the construction, he was satisfied that the necessary restrictions which the system imposed caused a waste of time to the extent of 25 per cent., at least an equal waste of money. But in the working, the results would, he believed, be far more serious. How was it possible to work a railway efficiently, economically, and energetically, to develop the traffic, and adequately to meet the ever-varying demands of the public for accommodation, when a new foreman could not be appointed, nor his salary be fixed, without the manager undertaking a large amount of correspondence, involving duplicates and references to perhaps two or more jurisdictions, and a necessary delay of months. Take such a case as the London and North-Western Railway, and he asked could such a system be worked at all, if a correspondence begun in England had to be concluded in Calcutta, and passed through the Government Departments, before practical effect could be given to it. These departments, he fully admitted, were most anxious to do what was right and proper—desirous even to go out of their way to give facilities; but still that channel must be gone through, and the result of such a system, whatever its effects might be upon the original construction, would be felt, in his opinion, much more seriously afterwards, in the management and in the traffic arrangement.

To return to what he considered the system ought to be, and on which he spoke with some decision, from the experience he had had of its satisfactory working in another quarter. First, with regard to the construction of the railways, he thought that the Government should receive tenders from companies of capitalists for the completion and equipment of a line of railway, for example, between two given points, for a definite sum of money, and stating the amount of subvention they required from the Government, to be paid in cash, or by an equivalent. The character of the line, as regarded materials, workmanship, and accommodation, being defined, the maximum rates of fares, the regulations connected with the public service, such as conveyance of troops, &c., being fixed, the total capital, the amount of subvention, and the approval of the railway by the Government on the completion of the same, being provided and stipulated for, the construction and the working should be left entirely to the management of the company, who should take, as a first charge upon the nett revenue, interest upon their portion of the capital, up to an agreed amount, say 5 per cent., and the surplus revenue afterwards to be divided in agreed proportions between them and the Government. By so doing, all the energy of independent management would be brought to bear, and that management would work with the same responsibility and limitation as in this country. He believed that upon that system alone, the full advantages of railway communication in India, or in any other country, would be realized.

He would, for the sake of illustration, assume a case, that of a railway up the Indus Valley, 500 miles in length, and that the reasonable cost, including equipment, was £10,000 per mile, or that a capital of £5,000,000 would be required. Of this he would suppose the Government to furnish £5,000 per mile, or two and a half millions of capital, either in cash, or by an equivalent guarantee; and as the company would have to find the balance, and to satisfy the Government that the bargain had been efficiently carried out, there would be every possible responsibility thrown upon the executive, that all the money would be economically and judiciously applied. Then the working, subject to conditions with the Government similar to those he had indicated, should be conducted entirely by the company, who should rely upon the receipts of the railway alone for a percentage upon their capital up to, say, 5 per cent.; and, after that, the nett receipts should be divided, say two-thirds to the Government, and one-third to the company, as an inducement to the latter still farther to develop the traffic, and to work economically. This arrangement, of course, implied a proper audit of accounts for the satisfaction of the Government. He believed that it would be to the advantage of Government to apply this system of working to railways already opened for traffic, and to those now under construction; for instance, the lines from Kurrachee to Delhi, a length of from 600 to 700 miles, exclusive of the Indus Valley. For the privilege of working these lines, Government might receive, by tender, a contribution from a company of say three or three and a half millions sterling, which would be more than adequate for the subvention of the Indus Valley line, which, if carried out, would complete a system of 1,100 miles, or thereabouts, from Kurrachee to Delhi, with a preferential capital of about five and a half millions sterling, with a preferential interest of 5 per cent., and a further contingent advantage from surplus nett receipts. He was certain that the Government would get more profit under that system than under the present one, of taking the whole of the profits to meet the liabilities they had incurred, and they would have that contribution to apply to the extensions which might be made to this great backbone of railways throughout India; because though it was a poor country, mile for mile, yet when it was considered that there was one mile of railway in England for every 5,000 inhabitants, as against one mile of railway in India for every 50,000 inhabitants, it would at once be seen that, in India, the necessity for branches and extensions would grow in importance every year.

Looking to the rapid rate of increase of the trade of India, exhibited by the growth of the traffic on the Scinde Railway, in the face of the greatest possible hinderances to the transit of goods from the interior, he had the strongest possible conviction, that the application of individual skill and energy would realize a fair return upon all the capital which might be contributed, either by Government or by private capitalists, and concurrently, incalculable advantages would result to the trade of India generally.

He did not think it was necessary to enlarge his observations on this subject. He had pointed out what occurred to him as the rational system to adopt, a system which, he believed, might be made to work very practically. It was the system on which the Norwegian Trunk Railway was carried out. Parties in England contributed one-half the capital, and the Government the other half. The English contractors took 5 per cent. preference, and the Norwegian Government took 4 per cent., and the surplus was equally divided. That system had been carried out without any difficulty or contention whatever. He did not mean to say that those exact terms would apply to India; but a system which admitted of independent energy, and obviated the necessity of state interference in construction, and a restriction in all the arrangements by which alone railways could be effectually carried out, would, in his opinion, be found advantageous to that great empire, and economical to the Government.

TO CORRESPONDENTS.

M. E. (Salford).—The best practice allows a shrinkage of about 3-16ths of an inch, in a 36 in. wheel—that is to say, the tyre should be bored out 1-16th of an inch smaller than the wheel on which it is to be placed. This rule is, however, frequently departed from, much depending on the kind of iron of which the tyre is composed.

G. G.—Dr. Dauglish's patents are dated October 1st, 1856, number of specification, 2293; and August 21st, 1857, number of specification, 2224. We have given abstracts of both the patents.

AMATEUR.—If you have put colza oil on your drilling machine, we are not surprised that you should find it set fast and cut. Take it asunder, clean all the bearings, &c., with turpentine, clean carefully off, and use lard-oil, or sperm in future.

RECEIVED.—G. W.—J. N.—R. T.—E. H. N.

ANSWERED BY LETTER.—W. B.—T. F.—T. W. and Co.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

STEAM FIRE-ENGINE TRIALS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The MECHANICS' MAGAZINE of the 31st ult. contains a notice of the trial of the "Manhattan" American steam fire-engine, at the Shadwell entrance of the London Docks, on the 25th July last, and also an inaccuracy which I must correct.

It is said that the engine threw "a very steady jet through a 1¼ in. nozzle to a distance of 'about' 150 ft." The distance, as measured in my presence

and that of several other engineers, was 189 ft. in the first trial, and 190 ft. at the second. The measurements were made by the men of the London Fire-engine Establishment, and with the time, size of nozzle, pressures, &c., carefully noted by me; and as one or two of the reporters present copied my note, which they had every opportunity of verifying, I am rather puzzled to account for the curious results of this trial which have appeared in the different journals. The engine, I am informed, worked splendidly the evening before.

Your obedient,
Chas. F. T. Young, C.E.

7, Duke-street, Adelphi, August 4, 1863.

[As Mr. Young was present, he must be aware that the jets thrown for a few seconds to the distances he names did not deserve the term "steady," and the jet, although discharged from a nozzle 1¼ in. in diameter, was really ⅛ in. smaller, in consequence of the peculiar construction of the adjutage.—Ed. M. M.]

Miscellanea.

At the monthly meeting of the London Association of Foremen Engineers, held at Swithin's lane, on Saturday, the 1st inst.—Mr. Muir, of Woolwich Arsenal, in the chair—a Paper was read by Mr. Humes, "On the Construction of Locks."—Next week we hope to be able to furnish our readers with a copious report of that gentleman's successful exposition of lock making.

We regret to learn (says the *Levant Herald*) that the Porte has decided on erecting machinery for rolling and bending ships' armour plates. The immense cost of such apparatus, and of its subsequent working, will, we feel confident, speedily demonstrate that the work in question could be far better and more cheaply done in England—whence the machinery is to be brought—than at Yildiz-Kiosk, where the expensive experiment is to be tried. The advice which has counselled this investment is certainly far from sound.

Plumbago has recently been introduced as the basis of a superior cement for steam joints, and the general metallic connections of the engineer. It is composed of 6 parts of plumbago, 3 of slacked lime, 8 of sulphate of baryta, and 3 of boiled linseed oil. This compound, it is said, secures a perfectly air and steam-tight joint, much superior to that obtained by the use of red lead.

Directions have been received at Chatham Dockyard from the Admiralty for the construction of a 12-gun iron vessel, the first of a squadron of iron frigates of a somewhat smaller size than those of the "Warrior" and "Achilles" class, which are to be built from the designs of Mr. Reed, Chief Constructor of the Navy. The new vessel is to be commenced in No. 2 Dock as soon as the "Achilles" is completed, which will be in about three months. She is to be about 80 ft. shorter than the "Achilles," and altogether will, it is anticipated, be a decided improvement on the present large iron steamers.

It is stated that the Russian Government have given a large order to Messrs. Krupp, of Essen, in Prussia, for muzzle-loading guns of the heaviest description, for the purpose of arming the fortress of Cronstadt, and that they have also ordered a considerable number of steel projectiles.

The Alexandra Park Company, it is stated, have definitively arranged with Messrs. Kelk and Lucas for the purchase of the International Exhibition Building, and its re-erection on the ground of the company, according to new designs suited to give full effect to the general objects of the undertaking.

We see that "Bernot's Patent File-cutting Machine Company" have already placed their shares in the market. The project is certainly carried on with a spirit and energy which should secure that success which usually attends companies who have, as in this case, a good foundation on which to work.

There was launched on Saturday last, from the yard of Messrs. Palmer Brothers and Co., at Howden, a beautifully-modelled screw steamer named the "Royal Standard." She is the property of Messrs. Wilson and Chambers, of Liverpool, and is the first screw steamer built for the White Star line of Australian packets, for which trade this noble vessel is intended. The "Royal Standard" has three decks. She is 225 ft. long, 40 ft. beam, 27½ ft. deep; her measurement is 2,000 tons, and the height between decks is 7½ ft. clear. The engines are to be of 140-horse power nominal, and are constructed on the high-pressure surface-condensing principle. They are of the inverted direct-acting description, with cylinders 45 in. in diameter, and 42 in. stroke, supplied with steam of 60 lb. pressure from three cylindrical boilers.

The prospectus has been issued of the British and Foreign India-Rubber Company, with works at Nottingham, and in France and Belgium, for the purpose of carrying on and developing the manufacture of india rubber generally, on a much more extensive scale than has hitherto been attempted. The capital is fixed at £200,000, with a first issue of one-half of that amount. The application of india rubber to submarine telegraphy forms a very important feature in the plans of the company. This material was stated, in the report of the Government Commission on Telegraphs, to far exceed any other substance in its valuable properties as an insulator, and the directors state that they have every reason to believe, that on the plans they propose they will be able to adapt it to the purpose required, in a manner which has not hitherto been effected.

It is announced that an Anglo-French company is formed to provide the amount necessary for the construction of a gigantic balloon on a system invented by a M. Nadar, capable of raising 80 persons in a car two storeys high, which will contain provisions and other necessaries, including, it is said a printing press. The diameter of the balloon is to be equal to three-fourths the height of the towers of Notre Dame. 12,000 yards of white silk have been supplied by a Lyons manufacturer, at 7f. the yard. This monster balloon is to be inaugurated next month at the races of Baden-Baden. Subscribers for the trip have already set down their names. It is to last eight days and eight nights. After having made a trip across the Channel and another in the Mediterranean, the company at whose expense the balloon is to be constructed will exhibit it in London, Paris, and New York. The produce of the exhibitions is to be employed in the construction of a definitive aerial locomotive.

A new iron vessel, expressly built for the conveyance of petroleum, was launched on Saturday at Newcastle. The ship has, properly speaking, no hold, but a series of iron tanks extended from deck to keel. In contradistinction to the principle often necessarily adopted in many vessels built to suit particular carrying trades, neither the necessity of economizing space nor the nature of the intended cargoes have necessitated the builders of the "Atlantic" to depart from the most exact rules of taste in marine architecture; and the result is that, viewed from every point, the greatest elegance is visible in the design of their ship. Her length over all is 145 ft.; breadth of beam, 28¼ ft.; and depth, 16 ft. 9 in. The launch was extremely successful.

A correspondent of the *Colliery Guardian* states that, at the Blackleyhurst Collieries, near St. Helen's, Lancashire, worked by Samuel Stock, Esq., on the property of Sir Robert T. Gerard, Bart., on the 11th inst., in a downbrow in the Little Delf Mine, at a depth of about three hundred yards from the surface, a spring of oil was met with, which continued to flow with great force for some time from the floor of the mine, but has now nearly ceased. Steps, however, are being taken to prove whether any quantity of the oil exists in the strata or not. The colour is of brown amber, has little or no smell, what little there is seems to resemble linseed oil. This is considered very peculiar, as mineral oils generally smell very strong. It is of a highly lubricating nature, burns freely, and there is no doubt that if it exists in any quantity it will prove a valuable source of wealth.

The paddle-wheel steamer "Salamis," 250-horse power, which, according to rumours current at Chatham within the last few days, is intended to be fitted as a yacht for his Royal Highness the Prince of Wales, was taken out of Chatham harbour on Friday for the purpose of making her first trial of speed on the completion of the fitting of her engines. The engines were in charge of Mr. Ravenhill, of the firm of Ravenhill, Salkeld, and Co., by whom they have been manufactured, and the trial was watched on the part of the Admiralty by Mr. Baker, chief engineer, Mr. Lang, master shipwright, under whose superintendence the "Salamis" was built at Chatham Dockyard, and other officials belonging to the establishment. The vessel was in charge of Mr. Blakey, second master, Queen's pilot at Chatham. With 180 tons of coals on board, the "Salamis" drew 9 ft. 11 in. aft and 9 ft. 6 in. forward; or, in other words, she was on a nearly even keel. She is fitted with Morgan's patent feathering floats, and her engines are fitted with all the modern improvements. The diameter of the cylinders is 61 in., and the length of stroke 4 ft. 6 in. She has four boilers in which the steam is generated, and 10 furnaces, in addition to which she is fitted with superheated steam apparatus. The vessel was taken considerably past the Mouse Light, as far as the entrance to the Downs, when, with full boiler power, the speed of the vessel was very satisfactory. Two runs were made at the measured mile, Maplin Sands, at about three-quarter speed, and, notwithstanding that the paddle-wheels were only making an average of 34 revolutions per minute, the vessel attained an average speed of close upon 15 knots per hour. With an improved trim, and with 38 revolutions of the paddle-wheels, there is little doubt that she will attain an average of 16 knots per hour, which is exceedingly satisfactory. During the trial her engines worked with remarkable smoothness, and, notwithstanding that it was the first occasion of their being tried, there was no priming and no occasion to stop the machinery on account of hot bearings.

We learn from the *Times*, that Captain H. Broadhead, commanding the Steam Reserve at Portsmouth, and Mr. George Murdock, inspector of machinery afloat at the same port, have forwarded to the Admiralty for inspection the models, drawings, and specifications of a breech-loading gun and gun-carriage, the joint invention of the two officers, intended to supply the want of a heavy smooth-bore gun. The gun is bored throughout from muzzle to breech, the circumference at the latter end being slightly increased. The breech is closed by a screw-plug, which closes the breech effectually by a quarter turn after the plug has been slid into its position. The carriage on which the gun is mounted appears, however, to be of the most immediate importance. The difficulty experienced in working and training the 95 cwt. 68-pounders on the main decks of our iron ships during a cruise was found to be most serious, and it was acknowledged that some other mode of working and training such guns than by the bungling, slow, handspike method must be adopted to render the ships' maindeck guns efficient. To meet this difficulty the present carriage has been constructed. Two-cranked shafts are fixed underneath the carriage, with the apex in front on a cup-bearing resting on the deck, the rear ends of the cranks carrying metal trucks on wheels. By a side lever and rope-fall the gun and carriage can either be thrown on the cup-bearing and rear trucks, and thus become a pivot broadside gun, or it can become an ordinary broadside gun, by lifting with the lever the cup-bearing and rear trucks. As a pivot broadside gun, two men on each side of a 10-ton gun with a simple rope-fall in their hands can train it with the utmost rapidity and nicety, and without a handspike being at all brought into play.

A new pilot lifeboat, 23 ft. in length, built by the shipwright department of Woolwich Dockyard by order of the Board of Admiralty, from designs furnished by Mr. Turner, the master shipwright of the yard, was forwarded to Devonport by the steam storeship "Fox," on Wednesday. The boat, which is self-righting, cannot sink by reason of the buoyancy effected by air-cases and open tubes through the bottom. If turned over and filled with water it will right itself in about fifteen seconds. The air cases are moveable, so as to be easily taken out for painting and inspection, with the exception of the long middle trunk, through which the open tubes pass, and which is fastened to the boat for the purpose of strengthening her lengthways. Should any water penetrate into the trunk through any unforeseen mishap, it can be cleared out readily by the removal of some metal screws in the lower part of the sides of the trunk. But should the boat by any possibility ship a sea, filling her entirely, it would run out in fifteen seconds. If a small quantity of water should find its way into the joints of the cases they can be emptied by taking up the short piece of midship bottom board and the case under each side. The sailing qualities of the lifeboat were tested at various times in the river preparatory to her being despatched from Woolwich yard. On one occasion during a high wind, when all her sails were set, she continued her course buoyantly with her gunwale 12 in. under water. The boat is ordered to undergo an additional course of sea trials at Devonport for the information of the Lords of the Admiralty.

The *New York Herald* says:—The "Monitor" torpedo consists of a monster shell, 30 ft. long, weighing upwards of 6,000 lb., with a charge of 700 lb. of powder. By means of a raft—the "devil"—these shells are pushed some fifty feet ahead of the "Monitor," suspended at any desirable depth. We shall know in good time how the rebels succeed in ob-

structing the passage of the "Monitors" when armed with these terrible shells, the explosion of which will resemble an earthquake under water. It appears that the naval officers were afraid of employing the potent means placed at their disposal for clearing Charleston harbour of obstructions, for fear the explosion of the shells would act backwards on their vessels. As might be supposed, the constructor has guarded against such an occurrence. The Secretary of the Navy, with a view of removing all doubts on this point, ordered a trial to be made last winter with one of the rafts, the very "devil" afterwards towed to Port Royal. The trial proved eminently satisfactory; for although the shell pushed up a mountain of water 50 ft. high above the surface of the Hudson, near the head of the raft, not the slightest injury was sustained by the latter. The perfect preservation of slender pieces of wood attached under the raft, proved beyond a doubt that the effect of the explosion was, as had been designed, in the forward direction only. This singular feature of the "Monitor" torpedo we are not at liberty to describe. What we have stated on the subject can do no harm, as it is known at Richmond as well as at Washington. So also is the fact that a couple of shiploads of these under-water pioneers are now at hand where their good services are most needed. We therefore acquit Mr. Welles on the charge of want of enterprize as regards the torpedoes. But is it not time to order Admiral Dahlgren to put steam on the "Monitors" and push the torpedoes past Sumter up against those rebel obstructions?

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 3471, 3482, 3, 6, 23, 38.
Boilers and Furnaces—*none.*
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3473, 3482, 3486, 25.
Ships and Boats, including their fittings, 35.
Cultivation of the Soil, including agricultural implements and machines, 21.
Food and Beverages, including apparatus for preparing food for men and animals—*none.*
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 3476, 3481, 3483, 3484, 3489, 1, 4, 8, 16, 19, 27, 33, 34, 36.
Buildings and Building Materials, 28.
Lighting, Heating, and Ventilating, 3471, 3487, 3499, 7, 10, 13, 26, 31.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 3467, 3474, 3488, 11, 14, 17, 24, 29.
Metals, including apparatus for their manufacture, 3472, 3475, 9, 20, 22, 32, 37.
Chemistry and Photography—*none.*
Electrical Apparatus—*none.*
Warfare, 3469, 3478, 3485, 2, 18, 30.
Letter-Press Printing—*none*
Miscellaneous, 3468, 3470, 5, 12, 15.

3467. C. E. Wilson. *Improvements in articles of wearing apparel for the neck.* Dated December 29, 1862.

This invention applies to collars and scarfs, and consists in attaching to the front part of the bands of collars one or two bands of any material suitable for scarfs, which bands hang down, take the position of, and appear like an ordinary scarf; a stud or pin, or both, may be used to secure the article on the neck of the wearer. *Patent abandoned.*

3468. W. E. Newton. *Improvements in preserving organic substances from decay.* (A communication.) Dated December 29, 1862.

This invention consists in treating fresh skins with the heavy oil of tar, or other suitable hydro-carbon. *Patent completed.*

3469. W. Billinghurst and J. Requa. *An improved portable battery.* Dated December 29, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3470. J. Johnston. *An improved surface refrigerator.* Dated December 30, 1862.

This invention consists of an apparatus for cooling brewers' and distillers' worts and other liquids effectually and speedily without pipes or other appliances which prevent thorough cleanliness. It comprises a series of shallow troughs of cast iron or other material placed side by side, with a communication formed at each alternate end to admit of the water flowing continuously through the whole series. These troughs are formed with circular or rectangular studs or projections cast on the bottom, and on these are placed thin sheets of twined copper with indentations or sinkings on the upper surface thereof, formed at an angle of about 45 degs., with the sides in the direction of the flow of the liquor or wort which passes over them. The sides, ends, and divisions may be of cast iron, wood, or other material fastened to the water troughs, and securing the copper sheeting thereto. The liquor exposed to the action of the atmosphere flows over the copper plates, and the water flows beneath them in a contrary direction. The indentations in the surface of the copper-plates agitate the wort or heated liquid in its flow, thereby causing ripples, breaking up the stream at each indentation, and materially accelerating the cooling process by continually exposing a fresh combination of liquid to the action of the atmosphere and the cooling plates. The studs or projections in the bottom of the water troughs also break up the volume of water, and support the cooling plates, against the under surface of which at close intervals different particles of water are brought into contact in consequence of the obstruction presented by the studs. The wort or liquor to be cooled is admitted at one end of the refrigerator, and flows over the various channels to the outlet at the other extremity. The water flows in an opposite direction under a certain head or pressure to ensure positive contact with the cooling plates. The flow of water can be so regulated that the outlet it can be of about the same temperature as the liquor which enters at the same end. *Patent completed.*

3471. J. Robson, jun. *Improvements in ornamental fittings for domestic stove grates.* Dated December 30, 1862.

In carrying out this invention, the inventor takes ordinary coke, cinders, charcoal, coal, the refuse of furnaces, brick burrs, stones, or wood, or similar forms to coke or cinders, made of Paris plaster, or plastic substances, or stamped out of sheet metal, and gives them an electro-conducting surface, by rubbing them over with plumbago, or by dipping them into a solution of bisulphuret of carbon, and then into a weak solution of nitrate of silver and water. He then coats them by electro deposition with any of the ordinary metallic deposits, such, for example, as copper, and then connects the coke or other material herein described with an electric battery, and places the same in a deposition trough containing sulphate or other solution of copper, until the said coke or other material is coated with copper. He then removes the said materials, and dips them into ordinary acid pickle, and afterwards washes the same in water, and dries them in sawdust, or in any other ordinary manner, and lacquers or varnishes them for use; or he would sometimes coat the said coke or other materials with gold size, or other ordinary adhesive substance, and cover their surfaces with gold or bronze leaf, foil, or dust, parts of which he would sometimes burnish and varnish, when they would be ready for use to be filled into the grates required to be ornamented. *Patent abandoned.*

3472. J. H. Johnson. *Improvements in ingot moulds employed in the casting of steel and other metals.* (A communication.) Dated December 30, 1862.

This invention relates to a peculiar construction and arrangement of moulds to be employed in casting ingots of steel or other metals, and consists in making such moulds syphon-shaped, the metal being first poured into a main compartment, which communicates at its lower end only with one or more other compartments by a lateral aperture or apertures, the metal rising in such other compartments slowly and steadily, although poured rapidly into the main or filling compartment. Each of the compartments in connection with the main compartment is closed at the top with the exception of a small aperture for the escape of the air and gases. Any number of these compartments may be combined together in one apparatus, which is composed of several parts held together by bolts and keys, or otherwise, so as to be readily separated for the purpose of opening the several moulds when the ingots are to be removed. *Patent completed.*

3473. H. A. Bonneville. *Improvements in the manufacture of saddles.* (A communication.) Dated December 30, 1862.

This invention consists in an improved apparatus which offers the advantage of being able to employ the same saddle for horses of different sizes. This apparatus may be applied to all saddles, whatever may be the mode of construction of the saddle-tree, as well as to pack-saddles of other beasts of burden placed before and behind. The changes to be made in the apparatus, in order to adapt it to the above purposes, are to unite the stays in a different way by a double hinge, in cases where these parts are placed edgeways, or by a single hinge when they are placed flat. *Patent completed.*

3474. F. B. Anderson. *Improvements in watches and other timekeepers.* Dated December 30, 1862.

This invention consists in constructing those parts of watches and other time-keepers known as hollow fusees and as stops to prevent the main-spring from being overwound, as hereafter described. The patentee forms a disc on the arbor, by preference in a piece with it, and sinks a recess in the outside of the fusee brass, into which the disc is fitted and secured by soldering or other attachment. He forms a square on the back of the arbor, to receive what he terms a gatherer or stop, which works inside a steel split ring, formed with three or more teeth, and with an abutment on the inside thereof. As the watch is wound, the gatherer takes round a tooth at every complete revolution, until the spring is wound up, when the gatherer comes in contact with the abutment, and prevents overwinding. The split ring is encased in a box fastened on to the back of the pillar plate. *Patent completed.*

3475. W. and H. Bowser. *Improvements in coating and protecting iron or steel with another metal.* Dated December 30, 1862.

The arrangements for carrying out this invention comprise a reverberatory furnace for heating the iron or steel, and a chamber in close communication therewith, to which latter the iron or steel is transferred to have the coating metal applied to it. Arrangements may be made for working continuously; in other words, for gradually moving the articles through the furnace and coating chamber at a rate which can be adjusted to suit the heating powers of the furnace, and the size of the articles under treatment, and so that, whilst some are undergoing the latter part of their treatment, fresh articles may be entering and passing through the furnace. The iron or steel plate, sheet, or other like article to be coated, having had its surfaces rendered as clean as possible, must be heated to about a welding heat, or to such a heat that the copper or other coating metal will melt freely upon its surface. When sufficiently heated, the article is transferred to the coating chamber, wherein there is brought into contact with it the coating metal, in the form of sheets, strips, or grains, proportioned to suit the thickness of coating to be applied in one operation. When these operations are performed in a careful and skilful manner, the coating metal becomes most intimately and firmly united to the iron or steel article, and it spreads over and covers the edges and all exposed parts of the article, the combination being so complete, that the article may be subsequently re-heated, rolled, hammered, or drawn without the coating metal becoming separated. *Patent completed.*

3476. W. Mould. *Certain improvements in machinery or apparatus for plaiting or folding and measuring fabrics.* Dated December 30, 1862.

This invention consists in having two swinging concave blades or knives placed above a reciprocating table in the form of a segment of a circle, such table being supported in a suitable framework, and allowed to yield or fall, the yielding being obtained by means of a vertical rod, to which the yielding segmented table is attached, such rod sliding through the axis of the segment, and supported by means of a strong elastic material passing around the axis of the segment, and underneath a transverse section; fixed to the lower end of such vertical supporter rod, on each side of the segmented table, is a roller covered with india rubber, flannel, or other suitable material, and which may, if required, be actuated and caused to revolve in one direction by means of the cloth being forced beneath it, and retained in such position, during such repetition of the folding blades, by means of a ratchet wheel upon its end coming in contact with a pawl or catch. *Patent completed.*

3478. W. Richards. *Improvements in cannon and other firearms, and in apparatus connected therewith.* Dated December 30, 1862.

According to one portion of this invention, in constructing breech-loading cannon in which the bore is continued through the breech end of the piece, and the charge is introduced from behind, the patentee closes the breech for firing with a stopper fitting into the bore, and behind the stopper the sides or walls of the gun are cut through, so that a block or fitting piece may be introduced transversely across the bore, so as to support the stopper and prevent its being driven out at the back. The stopper has a rod or stem attached to it with a handle at the back, and the filling piece is slotted to allow this rod or stem to pass. After firing, in order again to load, the block or filling piece is raised until the bore is left clear, and then the stopper is drawn out at the back by hand; another projectile or cartridge is then introduced, the stopper is replaced, and the block or filling piece again lowered behind it. Lever apparatus is employed in order to raise the block or filling piece. *Patent completed.*

3479. W. Clark. *Improvements in governing apparatus.* (A communication.) Dated December 30, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3480. C. Beslay. *Improvements in steam-engines.* Dated December 30, 1862.

The object of this invention is to entirely obviate the condensation or formation of liquid in the interior of the cylinder, and even to make the cylinder a means of superheating the steam, instead of detracting from its effect as heretofore. For this purpose, the inventor envelopes the steam cylinder with a jacket somewhat as in ordinary, having a space of one or two inches between the jacket and the cylinder; this may also be the case with the bottom and cover. These spaces he puts in communication by means of two pipes, with an air chamber or chambers placed in the chimney or passages leading therefrom, and subject to the action of the heat and flame passing through the furnace. He disposes a fan or screw exhauster in a chamber, through which one of the tubes of communication passes, which, being driven, keeps up a constant circulation of air through the cylinder jacket, and returning thence to the air-heating chamber, to be again returned to the cylinder jacket, and so on. *Patent abandoned.*

3481. R. Bottomley. *Improvements in machinery for twisting and doubling yarns or threads of cotton and other fibrous materials.* Dated December 31, 1862.

This invention consists in placing the mechanism for pinching or holding the threads next to the first guide eyes for the threads, then the cushion or "list board," then the hooks or water trough, then another cushion or list board, and lastly the plummet rail; thus it will be seen that the position of the plummet rail and pinching or holding apparatus is reversed, and by this means the patentee obtains the drag of the cushions or list boards, guide eyes, and plummets, in combination with that of the pinching or holding apparatus for holding the threads when "winding-on." *Patent completed.*

3482. W. B. Adams. *Improvements in railways and tramways.* Dated December 31, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3483. F. Applegate. *Improvements in the manufacture of a kind of woollen cloth, known to the trade as doeskin.* Dated December 31, 1862.

This consists in the use of two kinds of weft, of the same shade of colour or dye, but of different commercial values, the one being dyed woaded or indigo colour, which is used

only for the face of the cloth, and the other a common or unwoaded colour which is used for the back of the cloth. *Patent completed.*

3484. J. S. Smith and J. Hardman. *Certain improvements in power looms for weaving.* Dated December 31, 1862.

This invention relates to that portion of the power loom known as the stopping or knocking-off motion employed to stop the further action of looms when the shuttle does not complete its race from box to box. The improvements consist in an arrangement of mechanism which is designed to release the knocking-off handle, and thereby transfer the snap from the fast to the loose pulley, and simultaneously to put a break upon the fly-wheel, which machinery may be thus described:—At a convenient place on the framing of the loom, beneath the stop rod finger, a rod is secured, upon which is a sliding piece carrying a rod to act upon the handle; this sliding piece is also connected by means of a wire or rod to a bell crank lever, one end of which may be brought into contact with the fly-wheel (as a break) upon the other end being acted upon or struck by a tappet secured in a catch box on the end of the tappet shaft which extends beyond the framing; thus if the shuttle does not enter the box, the stop rod finger strikes the sliding piece and releases the knocking-off handle, the sliding piece also draws the wire, which places the lever in a position to be struck and pressed by the extra tappet on the end of the tappet shaft, by which means a break is put on the fly-wheel and the stoppage of the loom is readily effected. *Patent abandoned.*

3485. J. W. P. Field. *Improvements in breech-loading firearms.* Dated December 31, 1862.

This invention has for its object the diminution of metal in the joint piece, so as to admit of its being inserted in the wood, and the gun thereby made in the form of an ordinary "bar" or front action lock gun. For this purpose, instead of employing a bolt with a circular motion, as usual, for closing the joint, the patentee adapts and applies a slotted bolt with a rectilinear motion to the pivot of the lever, such bolt being projected into a notch to close the joint by means of a cam or cams formed or fixed on the said pivot of the lever. The extent of movement of the bolt is limited by the length of the slot therein, and of the operating part of the cam or cams, and there is or may be a spring in the box in which the bolt is contained, which has a constant tendency to press the bolt into the notch. By the use of this form of bolt the width of the metallic joint piece is reduced, so as merely to form a guide on each side of the bolt. *Patent completed.*

3486. W. Clark. *Improvements in the arrangement of the parts of railway trains, and in the application of power for their propulsion.* (A communication.) Dated December 31, 1862.

This invention is based on the employment of several sets of driving wheels, which are individually rigid, but connected together so as to form a flexible train. Their number depends on the power of adhesion desired, or on the radius of the curves of the railroad, or the weight disposed on each wheel. *Patent abandoned.*

3487. J. M. Napier. *Improvements in heating apparatus.* Dated December 31, 1862.

This invention may be termed a water stove, and is peculiarly adapted for heating apartments where a regular and moderate warmth is required. The inventor employs a vessel of convenient form, and of dimensions suited to the apartment to be heated. This vessel contains water, which is heated by the application of gas jets to a portion of its exterior; and in order to increase the heating surface and economize the gas, he allows the heated products of combustion to pass through tubes or other passages placed in the body of the containing vessel before being conducted away from the stove into the chimney of the apartment, or otherwise into the outer atmosphere. When the water becomes heated, the heat passes off through the containing vessel, and is communicated to the air of the apartment. The surface of the stove which is in contact with the air should be of such extent that the water need not be raised to the boiling point in order to heat the apartment sufficiently. *Patent abandoned.*

3488. F. Jaques. *Improvements in cases for pipes, mouthpieces, cigars, and other analogous articles.* Dated December 31, 1862.

These cases are made either of wood, hard leather, papier maché, hard rubber compound, or other suitable material, the cases being provided with an elastic or spring joint, which will have the effect of closing the parts and keeping them closed without other appliances. This spring joint the inventor prefers to make of vulcanized india rubber; and in carrying out the invention, the case should be made in two parts, of some hard substance which will be sufficiently rigid to prevent the article contained therein from being broken. *Patent abandoned.*

3489. F. Lobet. *A new system of constructing double weft forks, applicable to every description of power looms.* Dated December 31, 1862.

The object of this invention is to construct and adapt to power looms an apparatus which shall have the effect of stopping the loom whenever the weft breaks, or the shuttle by any accident shall not enter its box properly. To this end, forks consisting of two, three, or more prongs, are deposited between the batten or slay between each end of the reed and the shuttle boxes. These forks are mounted on a spindle or shaft, so that they may vibrate thereon, and project slightly across the shuttle race. Spiral or other metal springs are adapted to the spindle or shaft for the purpose of drawing it, and the forks mounted thereon, round in one direction when the batten is driven forward. These spiral or metal springs tend to lift up the forks; but another set of springs is adapted to a stationary part of the loom, and is made to pull round the spindle or shaft and the forks in the opposite direction when the batten is drawn back. Another set of vibrating forks is mounted on a second spindle or shaft, the prongs of this second set of forks being so arranged that they will, when required, enter the spaces between the prongs of the first set of forks. Upon the fork spindles or shafts are mounted levers or arms which are connected in any convenient manner to the stop motion of the loom. *Patent completed.*

3490. W. Maltby. *Improved means of extinguishing fires by the use of substances not hitherto supplied.* Dated December 31, 1862.

In carrying out this invention, the inventor dissolves bisulphate of ammonia in about seven times its own weight of water. This solution he sprinkles or discharges in small jets over any burning mass, which has the effect of immediately arresting the flames, and quickly stopping the combustion. Although he prefers, and claims, the use of this solution of bisulphate of ammonia alone for this purpose, yet, in some cases, he finds it advantageous to use any soluble silicate, either combined with the latter or free. *Patent abandoned.*

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1. R. H. Collyer. *Improvements in the method of, an apparatus for, preparing materials for the manufacture of paper and similar purposes, part of the invention being also applicable to other operations in which materials are subject to the action of hot agents.* Dated January 1, 1863.

For the purposes of this invention, the patentee subjects the materials to showers of hot water and showers of alkaline liquor used alternately, and to superheated steam—that is to say, he heats the materials at intervals with showers of hot water, and at the same time acts on the materials with superheated steam, and between the showers of water he heats the materials with showers of alkaline solution or liquor, still continuing to inject superheated steam. Instead of superheated steam, as above, he sometimes uses hot air, or superheated steam and hot air together. *Patent completed.*

2. W. H. Brown. *Improvements in battery plates.* Dated January 1, 1863.

Hitherto battery plates have been made of malleable iron affixed to the sides of vessels of war without being hardened. Battery plates so made have proved insufficient to resist the flat-headed hardened shot and shell fired from the Whitworth gun. Now the present inventor proposes to harden one side or face of such battery plates to the depth of about one-fifth of their thickness, leaving the remaining four-fifths in a mild or ductile state to support the hardened part. *Patent abandoned.*

3. G. Allcroft. *Improvements in pressure gauges and vacuum gauges.* Dated January 1, 1863.

This invention consists of a circular case fitted with a dial and pointer of the ordinary kind. The pinion of the pivot on which the pointer is fixed is actuated by a toothed quadrant working on a suitable fulcrum, and there is a helical spring fixed to the tail of the aforesaid quadrant, and to a pin in the case for keeping the pointer steady. To the bottom of the case of the gauge a piece of metal is affixed, in which is fitted a corrugated steel plate of the ordinary kind, protected from corrosion by india rubber. At or near the centre of the aforesaid corrugated spring, and in contact therewith, the short curved end of a horizontal lever is adjusted upon a fulcrum pin, and to the long end of the said lever a short rod is connected by a pin, the upper end of the said short rod being connected to a slotted lever which may be adjusted to the toothed quadrant before mentioned by a set screw. The inventor proposes, in constructing pressure or vaccum gauges intended to be used in locomotive engines, to adapt a syphon or curved thermometer within the case of the gauge visible from the outside thereof. *Patent abandoned.*

4. M. E. Boura and A. E. Francis. *Improvements in the manufacture of elastic fabrics.* Dated January 1, 1863.

This invention has for its object the production of an elastic fabric or material consisting of a combination of fabrics with any suitable gums in an unvulcanized state, the whole so heated and combined in the process of manufacture that when finished the said fabric or materials shall possess elasticity. *Patent completed.*

5. J. T. Smith. *Improvements in obtaining motive power from steam and the products of combustion.* Dated January 1, 1863.

This invention consists in the following arrangements for obtaining power:—The inventor places a furnace or furnaces in the interior of a boiler, and supplies it or them with air by an air compressing pump or machine. He passes the whole of the heated air and other products of combustion from the furnace into the water in the boiler. The steam, hot air, gases, and other products are afterwards passed through a filter or tube, and are employed in a high-pressure engine; the cylinders of the engine are, by preference, lined with steel, or are made of chilled or case-hardened iron. In some cases he causes the feed water to pass through the fire bars which are made hollow for the purpose. *Patent abnadoned.*

6. R. Faulds. *Improvements in traction engines, or common road locomotives.* Dated January 1, 1863.

This invention has principally for its object the propelling and steering or manoeuvring of tracton engines in a more efficient manner than has hitherto been attained. The invention consists mainly in applying the propelling power (which may be obtained by steam-engine details arranged in any convenient way) to two or more pairs of wheels, whereby the necessary bite of the ground will be obtained without excessive weight and other inconvenience, whilst the ascending of inclined roads, or the drawing of extra loads, will thereby be greatly facilitated. *Patent abandoned.*

7. J. J. Southgate. *Improved arrangements for portable fire-escapes.* Dated January 1, 1863.

In carrying out this invention, the patentee provides loose trousers or a vest, or a complete suit of trousers and vest, or a bag or sack, made of strong canvas, or other strong and pliable material; or he substitutes for these what may be considered by most persons a more desirable thing, viz., a strong belt of leather or canvas provided with tongue and buckle or other adjusting fastener, he securely attaches thereto the lower end or ends of elastic or spring cords, and the other end or ends of such elastic or spring cords he secures to a ring, hook, or staple, so constructed that it may be readily secured to the wall or place, or to an article contained in the apartment in close proximity to the window, or other point of egress, so that the garment or garments, or the belt before mentioned, may, in case of fire, be applied without delay to the person of any one seeking to escape, who may upon casting off from the window or other place descend in a gradual manner, by reason that the whole weight of the body being suspended by the said elastic cords, the amount of the elastic power of the said combined cords being regulated by the average weight of what are known as heavy persons. People of less weight being brought down by the same means with the assistance of the hauling rope. The person using this escape is enabled to regulate to some extent his position by using his hands and legs, so as to keep out of the reach of flames issuing from the building, the same being, however, more amply provided against by means of the hauling rope or cord worked by any person or persons on the pavement or ground below. *Patent completed.*

8. J. Jones. *Improvements in finishing or stiffening textile fabrics.* Dated January 1, 1863.

According to this invention, the roller employed to apply the size, starch, or stiffening fluid to a suitable fabric is caused to move in opposition to the fabric, which in passing the roller comes in contact with a small core of the surface of the roller, by which the fabric receives the size, starch, or stiffening fluid from the surface of the roller, and is thereby stiffened without requiring the use of the ordinary pressing roller or cylinder with its back cloth and appurtenances. *Patent completed.*

9. W. Souter. *Certain apparatus for raising and planishing metals.* Dated January 1, 1863.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

10. W. Robinson. *An improvement or improvements in glasses for lamps used in ships, railway carriages, and for other like purposes.* Dated January 1, 1863.

This invention consists in moulding or otherwise forming these glasses, which are usually of a globular or hemispherical form, with raised ribs or flanges on the outside surface; these ribs or flanges may be in any suitable form or design, and by their production from the surface they preserve such surface from being scratched in placing the glasses in their positions, whilst at the same time a brilliant light and ornamental appearance are also ensured. *Patent completed.*

11. J. E. Baker and J. Landon. *Improvements in the construction of boots, shoes, and other coverings for the feet.* Dated January 1, 1863.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

12. W. A. Distin. *Improvements in pipes for smoking tobacco and other herbaceous compounds.* Dated January 2, 1863.

This invention relates to certain improvements upon a former invention, for which letters patent were granted to the present patentee, dated January 3, 1856, No. 18, for the invention of "Improvements in pipes for smoking;" and the present improvements consist in an improved mode of connecting the tube of the pipe to the bowl thereof, for which purpose the said tube and bowl are formed as follows:—The upper end of the bowl (which may be of any suitable substance or material) has a shallow recess formed therein with annular grooves, the said grooves communicating by a passage formed along and in the substance of the side of the bowl, with a reservoir at the bottom thereof for the passage of oil from the tobacco or other herb. Into the said recess a flange piece fits, the said flange piece being fixed around the lower part of the tube or stem of the pipe. A part of the said tube extends beyond and below the said flange piece, and such extended part fits into the upper end of the bowl of the pipe, after the smoking herb has been placed therein, to a level with one or more small holes made through the said bowl for lighting the contents thereof, and for admitting air thereto. There is a hole (or holes) formed in the side of this part of the stem or tube corresponding with the hole or holes through the side of the bowl, as before described, so that when it is required to light the pipe, or put it out, the same may be done by the smoker holding the bowl of the pipe with one hand, and turning the tube or stem partly round with the other hand, stop pins being adapted to the flange piece of the tube and bowl to ensure the proper opening and closing of the orifices in the bowl; or the same result may be obtained by constructing the tube or stem to lift up and push down. There is a hole formed across the tube of the pipe just above the flange piece before stated. A dome-shaped piece of thin metal fits air-tight around the aforesaid tube or stem and the upper part of the bowl of the pipe, and forms a chamber for the smoke which passes from the bottom of the bowl up a channel in the side of the said bowl, as in the bowl described in the specification of the aforesaid former patent, thence the smoke passes by the cross hole up the hole in the tube or stem to the mouth of the smoker. *Patent completed.*

13. F. C. Bakewell. *Improvements in apparatus f[...] burning oils and other inflammable fluids as fuel.* (A c[...]munication.) Dated January 2, 1863.

This invention consists in the employment of oil or [...] inflammable fluids of less specific gravity than w[...] fuel, for the purposes of heating, cooking, ge[...] steam, &c., by burning it without any wick or o[...] vehicle as it floats on the surface of a body of wate[...] which it is passed to supply the consumption ca[...] combustion. *Patent completed.*

14. C. Eyland. *An improvement or im[...] the manufacture of buckles.* Dated January 2[...]

This invention consists in making the [...] [...] used for vest backs and other simil[...] [...]forming the rim and centre b[...]

solid from one piece of metal, afterwards bending the chape and the point piece round the solid centre bar, thus making the buckle a double-acting one, with the chape capable of being turned either way. *Patent abandoned.*

15. H. Lyon. *Improvements in the finish and mode of packing cigars, and in apparatus used for these purposes.* Dated January 2, 1863.

This invention consists in ribbing cigars lengthwise or crosswise, or the ribs may run in both directions, forming the surface into squares. This finish is made at the same time the cigars are pressed into the required shape, the result being obtained by means of a fluted or ribbed board placed at the top and bottom of every layer of cigars. It is proposed to make up these ribbed cigars in the ordinary manner, but the improved mode and apparatus for packing are especially designed and adapted to cigars with the common finish. The apparatus used consists of a simple block containing as many holes as there are to be cigars in a bundle, the said holes being of such a size as to admit the ends of the cigars and conveniently arranged in circles. *Patent abandoned.*

16. A. Bamford, R. Blomley, R. Taylor, and J. Lett. *Improvements in looms for weaving.* Dated January 6, 1863.

This invention is not described apart from the drawings. *Patent completed.*

17. E. T. Hughes. *Improvements in producing designs upon velvets, cloth, furniture hangings, and similar materials.* (A communication.) Dated January 2, 1863.

In the manufacture of velvets, cloth, furniture hangings, and other fabrics, to produce raised, friezed, or tufted designs thereon, the inventor employs a warp of silk, cotton, hemp, flax, or other similar material, with a long weft of wool, and he is thereby enabled to produce various designs on the fabrics. To produce raised, friezed, or tufted designs on woollen fabrics, he uses woollen threads well twisted, which work close, and woollen threads not twisted so much, by which he obtains the desired effect. These friezed or tufted designs can be applied to all fabrics, such as carpets, velvet, furniture hangings, and materials for various other purposes. *Patent abandoned.*

18. W. H. Muntz. *An improved method of attaching sheathing to iron or other vessels.* Dated January 2, 1862.

This invention consists in attaching the sheets of india-rubber, or other insulating or "anti-galvanic" material, to the vessel's side, and the metal sheathing to the insulating material, by means of marine glue, or such other cement or adhesive substance as will resist the action of sea water, instead of nailing or riveting the same, as previously practised or proposed. *Patent completed.*

19. H. J. Sergeant. *Certain improvements in the method of dressing and finishing silk fabrics, and fabrics composed of silk, cotton, and wool.* Dated January 2, 1863.

This invention consists in the novel application, employment, and use of glazed paper as a surface to effect the dressing or finishing of the silk when wound upon a beam together prepared or otherwise. The silk is treated, as is customary, with a solution of gum or gelatine, and partially dried by means of fire or steam chests; it is then to be wound or rolled upon a beam, upon which the surface of paper is also wound in a continuous length, being supplied from another roller; thus the silk becomes enclosed within the surfaces of the paper, and pressure is given by giving tension to the paper. When the beam is full, it may be removed to a drying oven until thoroughly dried, or the paper may be made hot by subjecting it to heat before it is wound on with silk, and thus the silk becomes hot-pressed, dressed, and finished. *Patent completed.*

20. J. E. Dawson. *Improvements in the manufacture of wrought-metal piles, columns, and shafts.* Dated January 2, 1863.

For the purposes of this invention, in forming sheets of metal, each edge of a plate is rolled or formed with an interior flange or rib, and by preference of such exterior form at the butting edges, that when the edges of two plates butt together, the joint between them shall not be a plain or straight line. On the contrary, one butting face is made hollow, undulating, or concave, whilst the other is made undulating or convex, to fit the hollow, undulating, or concave face of the neighbouring plate, though this is not essential, as plain or flat butting surfaces may be formed to the flanges. A series of longitudinal plates, such as above described, are used in producing a pile, column, or shaft. The outside surfaces of the plates may be convex or otherwise, according to the external form intended to be given to a pile, column, or shaft composed of a number of such shafts. The plates forming a pile, column, or shaft are bound together by metal bands fixed externally, which may be shrunk on, or they may be welded on; or they may be otherwise fixed tightly round in any suitable manner, so as to hold the series of butting plates of which a pile, column, or shaft is composed securely together; or the plates of which a pile, column, or shaft is composed may be combined or held together in any other convenient manner. *Patent completed.*

21. R. C. Ransome. *Improvements in reaping machines.* (A communication.) Dated January 2, 1863.

For the purposes of this invention, in order to deliver the cut crop at the side of the machines in quantities suitable to be tied up into bundles, a single rake is used, which is mounted at the end of an arm which moves on a suitable axis. The lower ends of the rake teeth, when delivering the cut crop, come close to and are moved over the platform of the machine. The arm with its rake performs or reciprocates to and fro in the segment of a circle of about 90 deg. The platform of the machine is formed of a segment of a circle, the cut crop is received on to the front end of the platform where the cutters are situated, and the cut crop is delivered at the other end of the platform, which comes to the side of the machine. The outer edges of the platform are raised. The arm of the rake receives its reciprocating motion primarily from the rotary motion of the running wheel or wheels, from which the cutters also derive their motion in an ordinary manner. The rake in its return stroke, after delivering a quantity of the cut crop, is, as before stated, caused to rise and pass back over the platform, so that the teeth are well above the platform, and are also above the further quantity of the cut crop thereon. The requisite motions to the arm of the rake are by preference imparted to it by means of a crank pin or eccentric, or suitable cam, which gives motion to a connecting rod, which at its other end moves on a rocking lever or links. The connecting rod, by a lever mounted on an axis carried by the connecting rod, gives motion to the axis of the arm of the rake, and causes it to move in the arc of a circle, for which purpose one end of such axis of the arm is arranged to move or turn about an axis, whilst the arm of the rake is also made to perform a partial rotation by the outer end of the lever (the axis of which is carried by the connecting rod) being connected or attached to an arm or projection at the other end of the axis of the arm. And all the necessary motions to the rake are thus arranged to be given without any sudden or injurious changes of motion, but on the contrary all the motions are easy and steady. *Patent completed.*

22. A. S. Bolton. *Improvements in the manufacture of wire.* Dated January 2, 1863.

This invention consists in manufacturing wire in manner hereafter described—that is to say, the patentee takes a tube, pipe, or cylinder of copper, or copper alloy, and places therein a core or rod of solid copper or copper alloy, and he manufactures wire by rolling and drawing the same, or by both rolling and drawing the same to the size required. Or, he takes a core or rod of copper or copper alloy, and encloses it in two or more tubes, pipes, or cylinders of copper or copper alloy, and manufactures it into wire as before described, and that at one or more operations. *Patent completed.*

23. H. Jones. *Certain improvements in steam engines.* Dated January 3, 1863.

This invention relates to those descriptions of steam engines wherein the waste steam is not condensed; for instance, as in locomotive or traction engines, where it is used to increase the draught of the furnace, and the invention is designed to regulate the amount of such draught. The first part of the invention consists in regulating the amount of air caused by the waste steam, by lengthening or shortening the "blast pipe" through which the steam passes, for which purpose the upper part of the pipe is made to slide on the lower, and arranged with rack and pinion, or otherwise, so as to be raised or lowered by the engine-driver as required, the draught being decreased as the aperture of the "blast pipe" approaches the top of the funnel or smoke outlet, and increased as it is lowered therefrom. A second part of the invention consists in connecting the axle boxes of traction engines together by a bar embracing or connecting all the axle boxes on one side of the engine together, and those on the opposite side by a second bar so as to distribute or equalize the strain thereon. *Patent abandoned.*

24. E. Skull and E. Mealing. *Improvements in chairs and other seats or apparatus for sitting or reclining on, which improvements are also applicable to tables.* Dated January 3, 1863.

The object of these improvements is so to arrange the parts of chairs and other apparatus for sitting or reclining upon (as well as of tables) that when not in use or for the purpose of transit they may be readily folded in a compact form. For this purpose the legs on each side are hinged or turn upon centres affixed to the seat or surface for sitting or reclining upon, and they then, when the seat is in position for use, cross one another, and at the point of crossing a pin or stud in the one passes through and rests upon one end of a slot in the other. When the seat or other surface is required to be packed for transit, the seat or other surface will be folded between the legs, when the studs in one leg on each side will slide in the slots of the other, and all the parts will be flat. In the case of chairs or other seats with backs, one end of each side of the back is connected to corresponding legs by pin joints, whilst other pins pass into slots provided for them in such sides of the back. In like manner may elbows or other rests be similarly applied with corresponding pins and slots. The surfaces of tables may be connected in like manner to the legs to facilitate their folding. *Patent completed.*

25. W. Philippi. *Improvements in the manufacture of bearings and axle boxes for machinery, carriages, and railway rolling stock.* Dated January 3, 1863.

In carrying out this invention the patentee cuts or hollows out the bearing (as show in the drawings), into which spaces he presses the hereinafter described mixture. He cuts up into small pieces 10 lb. of paper, and adds to it 6 lb. of linseed oil. He well mixes and stirs up the two, and sprinkles thereon a mixture of 3 lb. of graphite, and 3 lb. of gypsum, and presses the whole into a homogeneous mass, and places so much of the material produced in the hollowing of the bearing as is necessary to fill the same under a pressure of three atmospheres. In order to give it the proper form, he makes use of a turned iron cylinder, having the form of the axis which is to work in the bearing. When the pressure is given, he places the bearing for 24 hours in a temperature of about 150 deg. Reaumur. *Patent completed.*

26. S. White. *Improvements in the method of and apparatus for purifying, bleaching, and refining oils, and oily and fatty matters.* Dated January 3, 1863.

This invention consists—as regards the method of purifying, bleaching, and refining oils, and oily and fatty substances—in introducing the oil or oily or fatty matters together with a reagent calculated to eliminate or separate the impurities contained in them into a vessel having small orifices or perforations in its sides, and revolving rapidly within a larger vessel, which is open to the atmospheric air, so that when the smaller vessel revolves, the oil or oily or fatty matter combined with the reagent which is used with it for the purpose of purification will be projected through the orifices in the sides of the smaller vessel in thin streams, which will be driven against the internal sides of the larger vessel, and thereby be scattered and subdivided, and will thus be presented, in a partially atomic state, or in a dewy form, to contact with the light and the atmospheric air, by which exposure of the oil or fatty or oily matters in a minutely subdivided state the light, and particularly the oxygen of the atmosphere, produces an improved purification of such oil or fatty matter. The invention cannot be fully described without reference to the drawings. *Patent completed.*

27. W. Astrop. *Improvements in the manufacture of paper.* Dated January 3, 1863.

This invention consists in the employment of fibrous portions of the roots of parsnips, carrots, and turnips, of all kinds, and of the roots, stems, and stalks of the beet, mangold wurtzell, chicory, and rhubarb plants; also of the fibre of the cocoa nut and leaves of the orange plant and flags or reeds; also horse and cattle manure for the manufacture of "half stuff" and pulp to be used in the production of paper and cardboard, the substances and materials hereinbefore enumerated being employed either separately or in any combination with each other, or with any of the ordinary pulps now used in the manufacture of paper and cardboard. *Patent completed.*

28. C. B. Clough. *Improvements in apparatus for curing smoky chimneys.* Dated January 3, 1863.

This invention relates to a peculiar construction and arrangement of chimney top, and consists in adapting to the outside of any ordinary earthenware or other chimney pot a covering of zinc, or other suitable metal or material, surrounding such pot, and leaving an annular space between the pot and the outer casing which should extend to the top of the pot. At the base of the casing, and on diametrically opposite sides thereof, the patentee forms two vertical apertures, and he devides the annular space by placing partitions in the space between the pot and the casing midway between the openings. The wind entering one of these opening is prevented from escaping through the opposite opening by the partitions above-mentioned, and consequently, an upward current of air is carried outside the pot on the windward side of the chimney. Two openings and partitions will be found to answer, but in some cases three or more openings with partitions between them may be employed so as to catch the wind from every quarter. *Patent completed.*

29. W. T. Smallware and C. B. Weaver. *Certain improvements in treating or covering strip steel or other suitable material for the making of crinoline skirts and other similar purposes for which the same may be applicable, and which same treatment and covering may be used for trimming and strengthening certain parts of ladies' dresses.* Dated January 3, 1863.

The object of this invention is to cover strips of steel, or other suitable material for crinolines, in such a way as —1, to provide the means (by forming a selvage) for sewing such covered material to the material or fabric of the skirt to which it is to be attached, the covering being effected in any suitable material or variety of colour, and may be done with great dispatch so as to ensure harmony; 2, to disguise the effect of the hoop-like appearance in crinoline skirts by weaving or producing in the loom at the time of covering the material or otherwise an additional broad flounce, frill, or other ornamental border to extend down below the covered steel, or other suitable material that may be used; 3, in enclosing two or more strips of steel or other material, the same being placed at suitable distances apart, the intermediate space being occupied with a woven fabric of any material or colour, so as to form what is technically called a "fulling," and which may be made with an outer selvage on both edges or frill, flounce, or other ornamental border, on one or both edges as preferred. *Patent abandoned.*

30. W. E. Newton. *An improved method of firing or discharging cannon and other firearms, a part of which invention is applicable generally to the firing of charges of powder.* (A communication.) Dated January 3, 1863.

The patentee claims—1, the combining with the barrel of the cannon or other firearm an insulated plug and extending through the metal from the bore to the outside, such insulating plug to be used with a cartridge having a fusee provided with two conducting wires, so that when inserted in the bore, one will be in contact with the bore, and the other will be in contact with the insulated plug set forth. 2, He claims as an improvement in fusees for igniting powder by electricity the connection of two conducting wires by a feeble or film-like conductor, whether such interposed feeble or film-like conductor be placed direct lyin contact with the powder or with a combustible substance interposed, as described. *Patent completed.*

31. E. B. Keeling. *An improvement in lighting halls, theatres, and other buildings.* Dated January 5, 1863.

This invention is intended to be applied to the lighting of halls, theatres, and other buildings, and relates to the diffusion of intense light, and to the prevention of shadows. The patentee takes an electric light, a lime light, or other source of intense light, and places it in some elevated spot above the space to be lighted. Under or before, or part under and part before this light, he suspends or fits a plain white, tinted, or coloured curtain or screen, and again in some instances he places under or before, or part under and part before, a ceiling of glass or other transparent medium. By these means he removes the obstacles that have hitherto prevented the successful application of the electric, lime, or other intense lights to the lighting of the interior of large rooms and public edifices, and that also have all but confined these sources of light to the position of mere scientific curiosities. It is well known that the chief obstacles have been the intense brilliancy of the lights, their unpleasant white or ghastly hue, and the dense black shadows thrown by them. The first, however, gives so far a margin that the medium of the curtain absolutely utilizes the objection by the sacrifice of brilliancy, but by the complete diffusion of the rays. The second obstacle is overcome by the tint or colour of the curtain or screen giving

any hue most desirable to assimilate with any of the lights now usually employed, whether it be that of gas, of any description of oil lamp, of that of any wax or other candles. The relative use of the curtain or screen to the source of light is the same as that of the clouds to the sun. *Patent completed.*

32. H. Yates. *Improvements in machinery used in the manufacture of shovels and spades, and for raising and shaping metals for other purposes.* Dated January 5, 1863.

This machinery consists, essentially, of a pair of dies having the figure of the shovel or spade or other articles to be shaped. The inventor makes the upper die of the said pair upon a joint on an upright connected to the lower die, the said upper die being capable of being raised from the lower die to the required distance by turning on the said joint. That end of the upper die furthest from the joint has a handle or rod connected to it, by means of which handle or rod the upper die can be raised or brought down upon the lower die. To facilitate the raising of the upper die he connects a balance weight to it near the joint, the said balance weight enabling the workman to raise the upper die with little difficulty. The said balance weight also assists in giving the required momentum to the upper die when it is brought down upon the lower one by the workman. *Patent abandoned.*

33. J. A. Cooper. *The application of a fibre obtained from a certain plant as a substitute or to be used with silk, cotton, flax, and such like materials, which fibre has not been hitherto applied to any of those purposes, and for certain methods of preparing the same for such purposes.* Dated January 5, 1863.

This invention consists in using the fibre which is found immediately under the bark of the plant called the periwinkle as a substitute for, and using the said fibre in combination with, silk, cotton, flax, and such like materials, the same, when properly prepared, being spun into thread and woven into textile fabrics. *Patent abandoned.*

34. J. Howard and J. Bullough. *Improvements in warping or beaming machines.* Dated January 5, 1863.

This invention is not fully described apart from the drawings. *Patent completed.*

35. H. Blacktin. *Improvements in apparatus for saving or preserving money, papers, or other valuable property at sea in case of shipwreck.* (A communication.) Dated January 5, 1863.

This invention consists of a waterproof vessel constructed in the form of a boat, or any other convenient form and size, and of suitable materials, so as to be capable of floating and resisting the action of water and rocks or other bodies. One or two openings or hatchways are made in the top of the vessel, to which covers or lids are to be fixed by screws, bolts, locks, or other suitable means, and whereby they are capable of being made water-tight; money, papers, or other valuable property may then be enclosed in this vessel, and the vessel conveniently placed on shipboard, and which, in case of shipwreck, may be thrown overboard, when it will float ashore, where it may be picked up and the contents be thus saved or preserved. *Patent abandoned.*

36. A. Monnet. *Improvements in twisting and throwing silk and other fibres.* Dated January 5, 1863.

For the purpose of twisting silk and other fibres, three, four, or other number of fibres are drawn off from bobbins on which they have been previously wound, and are caused to pass down under a pulley of glass or earthenware contained in a reservoir of water, the fibres thus moistened pass up over another guide or pulley, and then pass to the twisting apparatus. The twisting apparatus consists of a spindle caused to rotate rapidly by means of a driving band moving in contact with a whirl upon it. The spindle receives at its upper end a circle or ring of metal, which receives and winds up the fibres as they are twisted. This circle or ring is concentric with the spindle, and revolves with it. Within the circle or ring there is gearing or wheelwork actuated by the spindle, and giving motion to a guide through which the fibres pass to be wound on the circle or ring. This guide the gearing causes to travel slowly around the circle or ring, so as to wind thereon the fibre which it carries. For throwing together two or more strands of twisted fibres, the circles or rings with the fibres wound upon them, as already described, are placed on axes, and the strands are drawn from them and passed as in the twisting operation under a pulley contained in the reservoir of water; the strands are then taken over other guides which place them side by side, and they then descend to twisting or throwing apparatus arranged as already described, but revolving in the opposite direction, so that the throwing apparatus whilst laying the strands together takes off more or less of the twist previously put upon the strands. *Patent abandoned.*

37. H. Bessemer. *Improvements in the construction and mode of apparatus to be employed in pressing, moulding, shaping, embossing, crushing, shearing, and cutting metallic and other substances.* Dated January 5, 1863.

The patentee claims—1, Transmitting to the rams of hydraulic presses a self-acting and continuous reciprocating motion through a limited and regulated distance. 2, Transmitting to the rams of hydraulic presses during a portion or near the end of each stroke or pulsation of the rams the force stored or accumulated in a heavy revolving flywheel during the inoperative portion of the stroke of such rams. 3, The method or methods described of regulating the distance apart of the cutting or pressing surfaces or dies employed in hydraulic presses having a continuous reciprocating motion. 4, The employment of a sliding frame in hydraulic presses for the purpose of transmitting the force of the ram in a downward direction on to the article or matter under operation. 5, The employment in hydraulic presses of two pistons acting simultaneously on one cross-head or pressing frame, as described. 6, The employment of two or more rams in one hydraulic press frame, such rams acting independently or simultaneously, as described. 7, The employment of one-armed hydraulic presses in the moulding, shaping, shearing, and pressing of metallic and other substances. 8, The employment of a table or support, with or without rollers, as described, when used in combination with a hydraulic press employed in pressing, shaping, "cogging," or forging ingots, blooms, or other masses of malleable iron or steel. 9, The continuous working of a plunger or force pump not furnished with valves and communicating with such presses. 10, The apparatus described for crushing ore and mineral or other substances. *Patent completed.*

38. H. Chamberlain. *Improvements in generating and condensing steam and evaporating liquids, and in the apparatus employed therein.* Dated January 5, 1863.

In generating steam, according to this invention, the patentee causes a fine spray of hot water, mingled with a small proportion of steam, to be directed between the convolutions of one or more coils of hot-water pipes contained within the generator, such hot-water pipes being connected to coils of similar hot-water pipes contained in a suitable heating chamber or furnace, and give out their heat to the spray and convert it wholly into steam. The steam is collected in a steam chest or chamber inside the generator, and passes off by a steam pipe for use in the ordinary manner. A constant circulation of water is maintained through the heating coils in the generator, and in the heating chamber or furnace by the aid of a centrifugal pump or other water-forcing apparatus. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated March 19, 1863.

737. H. O. Haughton, merchant. Improvements in machinery for drying and cooling grain and seeds. (A communication.)

Dated April 21, 1863.

992. H., E., and S. Yeadon, Stockport, and J. Yeadon, Leeds, reedmakers. Improved healds for weaving.

Dated June 11, 1863.

1455. C. L. V. Tenac, Tredegar, South Wales, civil engineer. A new or improved daily balance book with moveable or sliding tickets or slips. (A communication.)

Dated June 22, 1863.

1561. J. Sainty, Burnham Market, Norfolk, agricultural implement manufacturer. An improved turnip cutter for cutting the last slice.

1563. A. Twaddell, Glasgow, manufacturer. Improvements in sizing or preparing warps.

1597. L. A. Majolier, Stoke Newington, merchant. Improvements in apparatus for carburetting gases. (A communication.)

1769. W. Clark, 53, Chancery-lane, engineer. Improvements in apparatus for charging air or gases with combustible vapours. (A communication.)

1571. W. L. and T. Winans, Dover-street, gentlemen. Improvements in adapting propellers for propelling ocean steam vessels.

1573. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in printing machinery. (A communication.)

Dated June 23, 1863.

1575. J. Murray, Glasgow, engineer. Improvements in machinery for making chains or chain cables and rings.

1577. J. Ellison and A. Rogerson, mechanics, Bury. Improvements in slubbing, intermediate and roving frames, in throstles and winding machines used for the manufacture of cotton or other fibrous materials.

1579. S. Robinson, mechanic, J. Priestley and J. Foulds, overlookers, Bradford, York. Improvements in looms for weaving.

1581. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in breech-loading arms. (A communication.)

1583. W. L. and T. Winans, Dover-street, gentlemen. Improvements in lessening the friction of the rubbing surfaces of the slide-valves of engines and of the journals of shafts.

1585. E. Brooks, Birmingham, manufacturer. Improvemenes in breech-loading firearms.

1587. F. Feichtinger, 26, Cumberland-street South, Belgravia. Improvements in the manufacture of paper applicable for hemorrhoidal complaints.

Dated June 24, 1863.

1589. S. Knowles, calico printer, and R. Hayward, machine engraver, Tottington Mill, near Bury, Lancashire. Improvements in machinery for plaiting and measuring woven fabrics.

1595. T. Skinner, Sheffield, electro-plater and engraver. Improvements in the ornamentation of silver, German silver, Britannia metal, electro-plated, or other plated goods.

Dated June 25, 1863.

1597. R. Ripley, Brook-street, West-square, Lambeth, engineer. Improvements in the method and contruction of a packing, chiefly applicable to piston rods, pumps, and such like, and for forming the joints of gas, steam, or water pipes.

1601. J. O. Mathieu, Paris, gentleman. Improvements in twisting machines, particularly applicable to the manufacture of strings, strands, ropes, or cables.

1607. J. Head and H. Brinsmead, Ipswich. Improvements in machinery applicable to thrashing machines, and for cutting and bruising straw.

Dated June 26, 1863.

1609. W. Clark, 53, Chancery-lane, engineer. Improvements in apparatus for aërating liquids. (A communication.)

1611. W. E. Gedge, 11, Wellington-street, Strand. Improved apparatus for placing tyres on wheels, or hooping or feruling generally, while the metal is hot. (A communication.)

1613. R. Mushet, Coleford, metallurgist. Improvements in the manufacture of iron and steel.

Dated June 27, 1863.

1617. E. T. Hughes, 123, Chancery-lane. Improvements in couplings for hose pipes, and also in connecting axles to the naves or bosses of wheels. (A communication.)

Dated June 29, 1863.

1621. C. Avery, 39, Craven-street, Strand. Improvements in rotary engines.

Dated June 30, 1863.

1623. F. J. Duggan, Bristol, oil and colour merchant. Improved methods of connecting lamp chimneys and other glasses or shades with the burners of lamps.

1627. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in machinery or apparatus for moulding or shaping pottery ware. (A communication.)

1629. C. H. Gardner, West Harding-street, Fetter-lane, lithographic press manufacturer. Improvements in lithographic and zincographic presses.

1631. S. Cole, Moseley, Worcester, manufacturer. Improvements in clasps or fastenings for securing brooches, solitaires, and other dress ornaments.

Dated July 1, 1863.

1633. J. Blake, Accrington, engineer. Improvements in apparatus for reducing and regulating the pressure or quantity of steam, and in discharging the water of condensed steam from cylinders, pipes, and other vessels.

1635. W. Snell, 16, Clement's-inn, Strand. An improved waterproof material. (A communication.)

1637. C. P. Coles, Southsea, captain in the Royal Navy. An improved method of, and apparatus for, working guns in vessels and forts, and discharging them under water.

1639. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in coating or covering metal sheets with metals or alloys, and in the apparatus employed therein. (A communication.)

1641. T. Taylor, Wandsworth. Improvements in railway brakes.

Dated July 2, 1863.

1645. J. J. Shedlock, Vincent-street, Westminster, gas engineer. Improvements in wet gas meters.

1647. A. A. Croll, Coleman-street, engineer. Improvements in the preparation of materials to be used in the purification of gas for illumination.

Dated July 3, 1863.

1652. C. Martin, Brentford, civil engineer. Improvements in the treatment and preparation of materials for the manufacture of paper.

1655. R. Davison, London-street, civil engineer. Improvements in machinery for decorticating and cleaning corn and other grain. (A communication.)

1657. H. Brinsmead, Ipswich. Improvements in cooking apparatus.

1659. H. S. Warner, Trinidad, gentleman. An improved mode of, and apparatus for, treating or preparing megass and other substances to be used as fuel.

Dated July 4, 1863.

1661. J. C. Macdonald, Waddon, near Croydon, and J. Calverley, 26, George-street, Peckham. Improvements in the manufacture and application of printing apparatus.

1662. M. E. Eyth, 60, Boulevard de Strasbourg, Paris, engineer. An improved rotative engine.

1663. J. McDonald, Ashton-under-Lyne, manager. Certain improvements in jacquard looms.

1665. J. Grimson, Leicester, engineer. Improvements in shuttles for weaving narrow fabrics, and in mounting and fitting them to the battens.

1669. A. Norman, Clarendon-road, Notting-hill, gentleman. An improved apparatus for fanning or for agitating air.

1671. G. A. Barrett, W. Exall, C. J. Andrews, and A. Barrett, Reading, engineers, and J. L. Bowhay, Modbury. Improvements in the arrangement and construction of fixed and portable combined thrashing machines.

Dated July 6, 1863.

1674. W. B. Adams, Holly Mount, Hampstead, engineer. Improvements in wheels and their tyres, axles, and axle-boxes.

Dated July 8, 1863.

1696. J. Gibson, 31, Ormond-quay, and S., R., and W. Trulock, Essex-quay, Dublin. Improvements in breech-loading firearms.

1702. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the construction of locks and fastenings. (A communication.)

Dated July 13, 1863.

1744. H. N. King, 42a, Milsom-street, Bath, photographic artist. An improved mode of, and apparatus for, producing spectral illusions on the stage.

1750. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in sizing or gumming warp and weft threads. (A communication.)

Dated July 15, 1863.

1776. Dr. C. Clemm, Dresden, Germany. New employment of magnesia and its combinations in manufactures.

Dated July 16, 1863.

1780. S. A. Cooper, packing-case maker, 5, Lower Chapman-street, St. George's East. An improved packing case to contain bottled beer, wine, or any other liquid in bottle.

1786. G. Rand, Stoneham, Hants. Improvements in the the means of, and apparatus for, boiling and cooking.

Dated July 17, 1863.

1798. E. Alcan, King-street, City, merchant. An improvement in gas burners. (A communication.)

1800. G. F. Wilson and G. Payne, Sherwood Works, Battersea. Improvements in the manufacture of soap.

Dated June 18, 1863.

1806. J. Murdoch, Portsmouth, Hants. Improvements in the construction of steam and vacuum gauges.

Dated July 20, 1863.

1808. W. Simpson, engineer, and J. Hutton, accountant, Northampton. Improvements in the manufacture of hollow cutting tools.

1810. R. B. Brassey, manufacturer, and J. Hargreaves, manager, Ashton-under-Lyne, Lancashire. Improvements in machinery or apparatus for sizing and drying yarns and fabrics.

1812. J. and W. H. Bailey, Albion Works, Salford, Lancaster, turret clock makers. Improvements in apparatus for the prevention of boiler explosions.

1814. W. H. Gedge, 11, Wellington-street, Strand. Im-

provements applicable to inland navigation. (A communication.)

1816. F. Ayckbourn, Moreton-street, patent bed manufacturer. Improvements in air and water beds, pillows, bolsters, and cushions.

1818. R. Weare, Northwood, Stoke-upon-Trent, merchant. Improvements in water-closets, commodes, slop pails, and other like apparatus or utensils.

Dated July 21, 1863.

1824. C. S. Duncan, Inverness-road, Bayswater. Improvements in the means of, and apparatus for, heating, melting, boiling, evaporating, and other useful purposes.

1826. J. E. Varmer, Coleman-street. Improvements in the manufacture of umbrellas and parasols.

1828. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in watches and other timekeepers. (A communication.)

1830. W. Naylor, Queen's-road, Dalston, engineer. Improvements in safety valves and in apparatus connected therewith.

Dated July 22, 1863.

1832. P. R. Jackson, Rolling Mills, Salford, engineer. Improvements in machinery for rolling hoops and tyres.

1838. I. Perrin, Birmingham, Warwick, engineer. An improved danger signal to be used on rifle, artillery, and other practising grounds.

Dated July 23, 1863.

1844. G. Davies, Serle-street, Lincoln's-inn, civil engineer. An improvement in revolving firearms. (A communication.)

1848. W. Clark, 53, Chancery-lane, engineer. Improvements in saddles. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated July 23, 1863.

1846. M. Meisel, 14, Park-walk, West Brompton, engineer. An improved apparatus for regulating the speed of trains on railways, and in assisting the locomotive engine and train in ascending and descending inclined planes. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, August 4, 1863.

655. W. J. Clapp and N. Coats. Armour plates.
737. H. O. Haughton. Drying and cooling grain and seeds. (A communication.)
740. C. Webster and W. Forgie. Clearing out the interior of foul chimneys or flues when on fire or otherwise.
743. R. Couchman. Supporting or carrying ladies' parasols.
762. H. Hancock. Making gas.
766. J. Eyles. Cheffonier bedsteads.
769. J. Reilly and W. Martin. Lubricating horizontal shafting and bearings.
781. C. Monson. Gravitation engine.
782. R. Armitage and C. Senior. Stretching fabrics.
787. L. Christofleau. Firearms.
790. M. L. Parnell. Locks.
792. W. Johnson. Pocket-books, purses, wallets, and bill-cases.
802. W. M. Morgan. Coating metals.
803. R. A. Brooman. Scouring wool. (A communication.)
804. J. Taylor, jun. Rain-water pipes.
815. J. Dale and G. Bischof, jun. Manufacture of aniline, napthylamine, and other analogous bodies.
816. J. Musgrave. Steam boilers.
825. J. Smethurst. Steam engines and boilers.
830. R. A. Brooman. Electric telegraph printing apparatus. (A communication.)
832. H. Hamer. Tanning.
838. M. Henry. Lubricating. (A communication.)
846. J. W. Law and J. Inglis. Moulds for casting.
853. A. P. Price. Manufacture, production, and refining of metals.
864. F. C. Bakewell. Wicks for lamps. (A communication.)
865. B. Cooper. Feeding scribbling or carding engines.
881. A. V. Newton. Projectiles. (A communication.)
902. A. V. Newton. An offensive weapon. (A communication.)
904. A. V. Newton. Stirrups. (A communication.)
921. P. P. Raly. Constructing breakwaters, piers, sea-walls, and other similar structures.
1066. J. H. Johnson. Drying and cooling grain. (A communication.)
1071. G. Davies. Agitating and mixing substances. (A communication.)
1095. J. McF. Gray. Riveting, caulking, chipping, and otherwise operating upon and treating metals and other substances.
1242. H. Bennett. Puddling iron.
1350. W. Loeder. Rails for railways. (A communication.)
1424. W. E. Newton. Needles. (A communication.)
1567. L. A. Majolier. Carburetting gases. (A communication.)
1575. J. Murray. Making chains, or chain cable and rings.
1702. W. E. Newton. Locks and fastenings. (A communication.)
1726. R. Hornsby, jun., J. Bognall, and W. Astbury. Traction engines.
1788. A. Montleart and W. Tent. Attaching hooks to furniture.
1846. M. Meisel. Regulating the speed of trains on railways. (A communication.)

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 31, 1863.

304. J. Fletcher and H. Bower.
305. A. T. Blakely and J. Vavasseur.
312. T. Bradford.
318. W. T. Weston.
319. B. Russ.
328. R. A. Brooman.
330. R. A. Brooman.
337. R. A. Brooman.
345. G. Turner.
354. B. Dobson and E. Barlow.
366. J. F. Bottom.
385. G. H. Birkbeck.
403. W. Baylis and T. H. Hopwood.
559. W. Clark.
805. F. J. Risse.

Sealed August 4, 1863.

351. M. Hackforth.
352. G. Redrup.
357. D. Law and J. Downie.
358. J. Goucher.
361. J. Crosby and J. B. Smith.
363. R. Burley.
365. M. Cartwright.
368. A. Corneau.
369. H. Donald.
370. E. T. Hughes.
371. J. Duckworth.
374. R. Saunders.
375. W. Symington.
376. R. A. Brooman.
378. H. Wycherley.
386. S. M. C. Innes.
389. J. F. Spencer.
390. J. Robertson.
489. J. P. F. Datichy.
520. J. Fitter.
643. A. V. Newton.
691. W. West.
1117. R. G. Kent.
1216. L. C. Chichester.
1456. J. Webster.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1856. J. Goucher.
1859. F. H. Trevithick and R. Jones.
1874. B. Arnold.
1880. S. S. Skipton.
1895. J. Higgins and T. S. Whitworth.
1896. T. Webb.
1900. G. Jeffries.
1919. J. Fielding, D. Whittaker, and B. Crossdale.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1793. J. Knowles and W. Buxton.
1820. W. Wood and M. Smith.
1988. E. A. Cowper.

LIST OF SPECIFICATIONS PUBLISHED
For the Week ending August 1, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
*328	0 4	3396	0 4	3417	0 8	3433	0 4	3442	1 4	3452	1 2
3183	0 4	3397	1 2	3422	0 4	3434	0 4	3444	1 4	3455	0 10
3363	0 6	3400	0 8	3426	0 4	3435	0 10	3445	0 10	3456	0 4
3366	2 0	3401	0 8	3427	0 8	3436	0 4	3446	0 8	3459	0 10
3376	1 2	3402	0 8	3428	0 6	3437	0 4	3447	0 4	3460	0 4
3384	1 4	3408	0 8	3429	0 8	3438	0 6	3448	0 4	3461	0 10
3391	0 6	3411	0 6	3430	0 10	3439	0 8	3449	0 4	3462	0 8
3393	0 8	3412	0 4	3431	0 4	3440	0 4	3450	0 4	3464	0 4
3394	1 8	3416	0 10	3432	0 8	3441	0 4	3451	0 4	3465	0 10

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	p. ct.
IRON:—					
Welsh Bars, in London	per ton	6 5 0	to	6 15 0	2½
Nail Rods	do	7 0 0		7 5 0	
Hoops	do	8 5 0		8 10 0	
Sheets, single	do	9 5 0		9 15 0	
Staffordshire Bars	do	7 10 0		8 0 0	
Bars, in Wales	do	5 10 0		6 2 6	
Rails	do	5 15 0		6 0 0	nett
Foundry Pigs, at Glasg. No 1	do	2 11 0		2 15 0	
Swedish Bars	do	11 10 0		12 0 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		0 0 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	99 0 0		0 0 0	
Hammered Bottoms	do	109 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	104 0 0		0 0 0	
Tough Cake and Ingot	do	92 0 0		0 0 0	
Tile Copper	do	89 0 0		0 0 0	
Best Selected	do	95 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8¼		0 0 8½	
Fine Foreign	per ton	97 0 0		100 0 0	
TIN:—					
English Block	per cwt.	6 3 0		0 0 0	2½
do Bar	do	6 3 0		0 0 0	
do Refined	do	6 8 0		0 0 0	
Banca	do	6 11 0		0 0 0	
Straits	do	6 6 0		6 7 0	
TIN PLATES:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 6	
Second Quality	do	1 7 0		1 7 6	
Coke	do	1 3 0		1 4 0	
LEAD:—					
Pig, English	per ton	20 10 0		23 15 0	2½
,, Spanish Soft	do	19 17 6		19 10 0	
Shot, Patent	do	23 10 0		0 0 0	
Sheet	do	21 10 0		0 0 0	
White	do	27 0 0		27 10 0	
SPELTER:—					
On the spot	do	17 10 0		18 7 6	nett
ZINC:—					
English Sheet	do	23 0 0		0 0 0	2½
QUICKSILVER	per btl.	7 0 0		0 0 0	3
REGULUS OF ANTIMONY:—					
French star	per ton	42 0 0		0 2 0 0	

TIMBER, duty 1s. per load, drawback 1s.

Teak ... load	£12	0	£13	0	Archangel, yellow...	£13	0	£13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
,, yellow pine	3	10	4	10	Finlan	9	0	10	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	15	0
Quebec oak, white	5	10	6	10	Gothenburg, yellow	10	0	11	0
,, birch	3	10	4	10	,, white.	9	0	9	10
,, elm	3	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderhamn	9	10	10	10
,, fir	2	10	3	10	Christiania, per C., 12ft. by 3 by 9 in.				
Memel fir	3	5	3	10					
Riga	3	0	3	5	Christiania, yellow	21	0	23	0
Swedish	2	10	2	15	DeckPlank, Dantzic, per 40 ft. 3 in.	0	14	1	4
Masts, Quebec red pine	5	0	6	0					
,, yellow pine	5	0	6	0	PUMICE STONE pr ton	5	10	9	0
Lathwood, Dantzic, fm	5	10	6	10	OILS, &c.				
,, St. Petersburg	8	0	8	10	Seal, pale ...per tun	47	0	0	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	80	0	81	0
					Cod	53	0	0	0
					Whale, Sth Sea, pale	45	0	0	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	60	0	0	0
St. John, white spruce	14	0	15	10	Cocoanut, Cochin	48	0	49	0
Yellow pine, per reduced C.					Palm, fine	37	0	0	0
					Linseed	41	15	45	0
Canada, 1st qual.	17	0	18	0	Rapeseed Eng. pale	46	0	0	0
,, 2nd do.	11	0	12	0	Cottonseed	33	0	40	0

FRENCH & SMITH, Sworn Brokers,
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THE MECHANICS' MAGAZINE.

Contents of the Last Number:—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 14, 1863.

STEEL AS A MATERIAL IN THE CONSTRUCTION OF BRIDGES.

WHEN iron was originally introduced into the construction of bridges, it was thought that the natural fitness of things had been violated. Iron was, no doubt, stronger, every way, than stone; it was, perhaps, imperishable, certainly manageable, and, on the whole economical. Yet, not being habitual, it was hard to convince engineers that any combination of iron could constitute a veritable bridge. Of our early engineers many, it is to be remembered, were, at one time, stonemasons, and throughout life they remained faithful to the traditions of the craft. Familiarity with a special material, influences the ordinary modes of thought. We are very well aware who it is that is convinced that "there is nothing like leather." The Americans, accustomed to the general use of wood in engineering structures and in machinery, may be said to *think* in that material; and it is no wonder that all the conceptions of a stonemason should, in like manner, smell of the quarry and the stonecutter's yard. So for years stone bridges (and those of bricks, which are but artificial stones) were many, and iron spans were few. Interminable stone and brick viaducts were erected on our railways; and we believe it to be, even yet, a cherished tradition that for a very heavy traffic, such as that over London-bridge, "there is nothing like stone." But the limit of the practicable width of span is soon reached in stone bridges, and any considerable width requires a great proportionate rise. Kircher, it is true, speaking of stone bridges in China, from 3 to 4 miles long, mentions an arch of the incredible span of 600 ft. The widest stone span, however, of which there is any authentic record, was that of an arch of 251 ft. clear opening, formerly standing over the Adda, at Trezzo, not far from Milan. This great bridge was destroyed for military purposes, but the abutments and the curve of its lower intrados still attest its former greatness. The widest stone arch now standing is one of 220 ft. clearspan, and 57 ft. rise, on the line of the Washington aqueduct, U.S.; and next to this comes the noble arch, of 200 ft., and 42 ft. rise, of the Grosvenor-bridge over the Dee, at Chester. This is justly reckoned a great span, although it would be hardly noteworthy if executed in iron. The old bridge of Vieille, Brionde, over the Allier, in France, has a single span of 183¼ ft., with a rise of 70 ft. 3 in. The widest masonry arch yet executed for railway purposes, is that of 180 ft. span, and 90 ft. rise, over the River Ayr, on the line of the Glasgow and South-Western Railway.

We need not say how far such works, the greatest of their kind, are surpassed by spans of iron. Not considering suspension-bridges, iron spans of 400 ft. are now considered to present no difficulty. We have 460 ft. spans over the Menai Straits, and 455 ft. spans over the Tamar. The River Conway is crossed at a leap of 400 ft. The Vistula is crossed not far from Koenigsberg by an iron railway bridge having six spans of 397 ft.; and that over the Rhine at Cologne has four spans of 344 ft. 6 in. The Mayence has four spans also of 331 ft.; and 330 ft. is the width of the principal span of the Victoria bridge over the River St. Lawrence at Montreal. The Chepstow-bridge has a span of 306 ft.

The limit to the width of span, in any material, is in the weight of the material itself. The late Captain Moorsom obtained the prize in the Cologne-bridge competition for a design for a lattice bridge of two spans of 600 ft. each, and Mr. Fairbairn's design was for a tubular bridge with two spans of 570 ft. 6 in. each; yet it is demonstrable that, at a span of about 1,600 ft., a tubular bridge could bear only its own weight. Steel, of good working and welding quality, has a strength nearly or quite double that of ordinary bridge plates, the strength of which seldom averages 20 tons per square inch, while there is much that probably does not exceed 16 tons or thereabouts—thus, if 1,600 ft. is the limit of span in iron, it should be 3,200 ft. in steel; and if a span of 600 ft. be practicable with the former material, one of 1,200 ft., should be equally so with the latter. To double a given span, whether in iron or steel, requires at least twice the weight, per lineal foot, in the bridge itself; and where the weight of the bridge forms a large proportion of the whole load, the rate of increase is correspondingly greater. Yet a steel bridge of 600 ft. span need not, theoretically, contain more metal in the top and bottom members than an iron bridge of two spans of 300 ft. each, so that, as far as cost is concerned, the difference would consist in that of the cost of equal weights of steel and iron. As, however, a pier would be saved, this saving might be such as to render the steel bridge absolutely more economical in first cost than one of equal length in iron.

It is almost needless to say that steel is not necessarily brittle, as are the qualities used for cutlery. Steel is any combination of iron and carbon which, when heated and immersed in water, becomes harder. Even many commercial irons do this, and as iron is never entirely free from carbon, it is difficult, indeed, to say whether any specific specimen of carbonized iron is to be known as iron or steel. Certain it is that many irons are brittle, and certain marks of steel are nearly as tough as copper. Puddled steel, when it can be had of uniform quality, is not generally brittle; "homogeneous metal," so-called, is but a moderately carbonized steel of well known toughness, and Bessemer metal, although produced by a different process, partakes of the same qualities. The structural value of any metal is its absolute resistance, both to tensile and compressive strains, multiplied into the distance through which these strains act before the natural elasticity of the metal is permanently affected. The great absolute cohesion of steel would not, of course, entitle it to confidence when applied in important works of construction, did it not, also, possess "toughness," or considerable extensibility before rupture. Mr. Mallet has modified the co-efficients adopted by Poncelet, so as to express by **Te** and **Tr** the combined tensile strength and extensibility of a metal respectively at the elastic limit and at rupture, and corresponding co-efficients are also employed for compression at the elastic limit and at the crushing point. Half the strain multiplied into the distance through which it acts, gives a product either in foot-pounds or inch-pounds, expressive of the relative structural value of material when any known standard is taken for comparison. The test of a good steel for bridge plates will be that of high tensile and compressive resistance, combined with a good range of extensibility and compressibility. From the great progress lately made, and still being made, in the manufacture of steel, we may reasonably look for the production of a strong, tough metal upon a scale and at a price which, for bridges of large spans at least, will render it every way preferable to iron.

SMOKE PREVENTION.

THANKS to Mr. W. Williams, and one or two other gentlemen, engineers understand remarkably well how the evolution of smoke from a steam-engine furnace is to be prevented. Nevertheless, a trip to our manufacturing districts demonstrates clearly enough that the comprehension of scientific information is one thing, and its application in practice is another. We might, it is true, pick out one or more stacks in such towns as Manchester, Birmingham, Leeds, or Sheffield even, whose white-washed tops denote to the world beneath, in rather an ostentatious fashion, that the furnaces which supply them are expressly constructed to "consume their own smoke;" but such exceptions only prove the rule, exemplified by the dense cloud which hangs above, that smoke is not yet prevented, and that the last fifty years have done little or nothing to abate an enormous nuisance.

The question—"How is the appearance of smoke at the top of a stack to be prevented?" has long since received a satisfactory answer, which may be summed up in the two sentences, "Less air through the bars," and "More over them." Short as it is, it embodies the result of years of experience. The Patent-office, no doubt, contains the records of many hundreds of inventions, some ingenious and sensible, many quite the reverse, but all having the combustion or destruction of smoke in some way for their object. Fortunately, no complicated apparatus is necessary to accomplish the end in view, and thus most, if not all of these inventions, are not worth the paper they are printed on. They are, nevertheless, strong evidence of the desire entertained in the manufacturing world for many years; that the carrying on of a business which required the consumption of large quantities of coal should not inflict an injury or a nuisance on the surrounding town or its inhabitants: and with our present knowledge, it seems strange enough that there should ever be cause for the infliction of a legal penalty, or that reasons should exist to prevent us from white-washing all our stacks, instead of two or three out of as many hundreds. The question is no longer, "How can smoke be prevented?" but "*Why* is it not prevented?" It is one which, we think, permits of more easy solution than many imagine.

A large number of furnaces exist which cannot possibly be so constructed as to admit air in quantity above the burning fuel, without entailing such a change of form and structural arrangement as would simply render them useless for the object in view. In this class we may place puddling and blast furnaces, and many others which are intended to raise materials to a high heat without exposing them to the action of free oxygen. It is obvious that the introduction of air, anywhere but through the fire-bars, is incompatible with the attainment of the required end. Such furnaces smoke as a necessity, and are likely to continue to do so, unless some very radical changes, of which we see no prospect, are introduced into our iron manufacture. In some other cases of the same kind, the production of smoke might be greatly reduced, perhaps, were it not for the low price of coals, which renders any trifling advantage to be realized not worth the expense. All things considered, we may regard the question as being solely confined to steam boiler furnaces; and when we find that th[e] smoke as much, or more than they did h[alf a] century since, although they are under control of able men, who are well aware saving to be effected by the prev[ention of] smoke, in most of the situations in w[hich] power is employed, the denunciati[on]

a fact without due inquiry becomes absurd. In some few cases, it may, it is true, be a result of ignorance; but in the great majority of instances, on board our steam-boats, in our locomotives, and far and wide through the manufacturing regions, the cause will be found in want of power on the part of the boilers, to meet the demands made on them by overworked engines, and as a consequence, a system of firing which sets the conditions necessary for complete combustion at defiance.

The gases rising from burning fuel cannot be consumed without the admission of a very considerable quantity of air, in a state of subdivision, above the fire-bars. As a consequence, we find that, although the economical power of the boiler is increased, its total power is very considerably diminished—that is to say, a furnace which fulfils every condition required for the complete prevention of smoke, cannot, *cæteris paribus*, produce the same quantity of steam in the same time as one into which the fuel may be heaped without system, and the fire urged without regard to anything but the production of an intense heat. Thus steam-boats, locomotives, and stationary engines, can be counted by the hundred which, to use the popular phrase, "consume their own smoke," to perfection while engaged in ordinary work; yet the moment any extraordinary demand is made on their powers, volumes of dark vapour and unconsumed gases testify to the fact that the smoke-preventing arrangements are either unequal to the exertion, or deduct so much from the gross power of the boiler that they are purposely rendered inoperative for the time.

Theoretically speaking, nothing but cold air should be admitted to a steam engine furnace, for reasons we need not dwell on; but practically, we believe that the greatest advantage would be derived from the introduction of a volume of heated air above the fuel in combustion, in all cases where the fire-box or boiler is too small for the work it has to perform. There is always an ample supply of waste heat, which could be devoted to such a purpose by very simple arrangements. Better hot air than none; and a recourse to this system would greatly diminish smoke without reducing the powers of a boiler.

LOOSE RAILWAY WHEELS.

It is not easy to discover a greater mechanical absurdity than that involved in the system of fast wheels for railway carriages. It needs no abstruse knowledge of mathematics, to demonstrate the impracticability of causing two wheels of the same diameter to pass over different distances in the same time, while they are bound together by a rigid axle, which effectually prevents a corresponding difference in the number of revolutions, unless one or both act the part of sledges. Only suited for travelling on a line of rails geometrically straight, the instant a railway carriage enters on a curve, the wheels become sources of destruction which set economy at defiance, endanger the stability of the permanent way, and throw a serious strain on the axles. The conical shape given to the tyre, and once lauded as a practical remedy for a theoretical blunder, is now well understood to be useless, except so far as it tends to keep the flanges of the wheels clear of the rails. It would be perfect as a remedy only on certain conditions impossible to secure. These are, that all curves should be of the same radius; that the difference between the inside and outside diameter of the tyre was exactly proportioned to the radius of the curve and the gauge of the rails; and that the play of the wheels between the rails should be accurately adjusted, so as to permit the curve to exert its due effect; failing in any one of these, the principle is worthless. Many thousands of miles of railway track are daily hurried over by trains; and it certainly is not exaggeration to assert, that three-fourths of the distance is made up of curves of every imaginable radius, to which it is out of the question to adjust the cones of the wheels which run over them; and, as a result, we find flanges worn away in a few months, tyres deeply grooved, and the surface of rails laminated and abraded, until the iron, strong as ever as a mere girder, becomes useless as a roadway. Fully one-half the expense incurred by the replacement of track might be avoided by permitting each wheel of a pair to act freely for itself.

The cone, to be effectual even in theory, presupposes the existence not only of a given amount of lateral play between the rails, but that this play shall be available in the highest degree on curves. One of the fundamental principles, however, of railway construction is, that the outer rail in such cases shall be raised sufficiently to prevent the flanges of the outer wheels touching it. In order to secure safety, the increase of elevation is always proportionate to the highest speed at which a train is likely to pass round the curve. As a consequence, at slower speeds the inside flanges are brought into contact with the inner rail; so that the conical form of the tyre is injurious rather than beneficial. And even with fast trains the height of the outer rail is intended to, and does approximately as a rule, keep the wheels in the same relation to the track as that which they assume on a straight line. Wheels then cease to deserve the name; they become, instead, sledges of the very worst possible form. Further, six-wheel carriages cannot, under any circumstances, bring the cones of the middle wheels into action, in the legitimate sense; and for anything we can see to the contrary, they at least would be better if made truly cylindrical, with a slight swell at the root of the flange to impart strength.

We have purposely avoided touching on the evil induced by the axles diverging from the radii of the curve, both because it is of itself of less importance, and because the slight play of the bearings in the horn plates compensates for it in some degree.

Even though the cone system worked perfectly while wheels are new, it would still be imperfect, in that the tyres wear rapidly into channels from the small surface which they present to the rails, the tables of which, instead of leaning inwards, are either laid horizontally at first, or shortly become so from the failure or sinking of the sleepers. Thus the passage of a new wheel over a marked rail shows a line of contact perhaps less than half an inch wide. A little sledging round curves soon tells on such a bearing surface as this, and it does not require many trips to more than double it. Wear, once commenced, goes on rapidly, and the tyre, instead of a smooth cone, quickly becomes a grooved pulley; and what then becomes of the much-vaunted conical principle?

Considerable as the evil was even in Stephenson's day, when any expense was incurred (in order to avoid a sharp curve), it now assumes tenfold importance when curves are scarcely considered an evil, so long as they permit a train to be forced round them. Hence a system which might have worked passably well thirty years ago, totally fails to meet the demands made on it now. That it is still adhered to we regard as no evidence either of the intrinsic merit of the principle, or of the mechanical impossibility of replacing it by something better. It is rather a result of a conservatism which is not less admirable in moderation, than absurd when carried to excess. The mere fact of so constructing two wheels that they may revolve freely on a common axis, and yet retain all the working conditions which entitle them to confidence when employed under a railway carriage, presents no difficulty whatever. It settles down into a simple question of expense—which is unimportant in the face of the benefits gained—and weight, which deserves a good deal of attention.

Many inventions for attaining the desired end have been from time to time brought before the public; but we believe we are correct in stating that none of them have ever received a fair trial. We hope to go fully into the more strictly mechanical details of the question at an early opportunity; for the present, we may remark that one of the principal arguments urged against the introduction of loose wheels, is the enormous expense which the application of the system to existing rolling stock would entail. When we reflect, that the process might extend over a series of years by simply replacing old vehicles and wheels by new ones, constructed on different principles, the objection in a great degree loses weight; and in any case, the saving effected in repairs would provide an annual sum sufficient to pay a fair interest on the necessary outlay. The present expense of keeping tyres in running order is extravagant to a degree; and to the attempt to reduce it within more moderate limits, may be ascribed the use of hard brittle iron, instead of the soft tough metal formerly employed. We believe that the abandonment of fixed wheels would soon permit a return to the best fibrous Staffordshire tyres, now abandoned in favour of the hard Yorkshire irons, which are a source of accident which it would be as well to avoid, to say nothing of their destructive influence on the permanent way. Loose wheels have received a partial trial in America, and been spoken of very favourably even in a country where the peculiar "bogie" system scarcely renders a resort to such a plan necessary or advisable.

THE CHAIN CABLE AND ANCHOR BILL.

We regret to state that the prognostications we ventured to form about six weeks ago as to the fate of Mr. Laird's bill for this Session have turned out true; and after being read twice, the measure has been withdrawn, in consequence of its mutilation in Committee. We are, however, informed—from a source that must be reliable—that Mr. Laird intends to re-introduce his bill at an early stage of next Session. The rejection of the bill was perhaps to be expected, as it was at the outset an exceedingly crude measure; and when improved through the representations of Lloyd's and the general body of shipowners, it had scarcely sufficient time to encounter any eventual opposition of a character at all serious. Mr. Laird's bill did not determine a fixed size of chain in proportion to the tonnage of any given vessel; and the mere testing of any small chain and anchor would thus have been a legal compliance with the Act. The delusive character of this clause is evident; and, at the same time, penalties of an undue stringency were proposed to be laid upon the masters and owners of vessels. In many other respects several points involved in the nature of the business were disregarded; making the bill a dead letter to some, and a perplexity to most people. The revision of the bill by Lloyd's Registry and by the Shipowners' Association has, however, resulted in a modification of the

objectionable clauses and an addition of certain others; and there is thus little doubt that this now useful measure will be carried easily next Session. The withdrawal of the bill was mainly owing to the opposition of Messrs. Lindsay and Fenwick, the two members for Sunderland; who therein showed themselves the followers of the Board of Trade—in its usual opposition to any private member's bill.

The necessity for thoroughly testing the chain cables and anchors of ships is now so generally recognized, that measures are being adopted to furnish almost every important port in the country with proving-houses. Another machine will be laid down in a few weeks at Lloyd's proving-house at Poplar, in order to double the amount of work to be turned out. A Joint Stock Company of high local status has lately secured, by a long lease from the Corporation of Newcastle, a site for a testing-house at Walker, midway between Newcastle and Shields. By the end of the year, this establishment will be ready for action, in order to meet Lloyd's extended regulation—making imperative the testing of the anchorage tackle of all classed ships. A company is also being formed for Staffordshire, in order to supply the wants of that important district—where at present so many chains of a bad material are manufactured. Some of the Staffordshire chain-makers have already taken steps to form a company for testing chains; and it is not improbable they will unite with the London Company, now receiving the impetus towards its formation from Lloyd's. The Clyde is also an important seat of shipbuilding, though not of the chain and anchor manufacture, and it will require an establishment to meet the general wants of the district. No measures are at present being undertaken in Sunderland to meet Lloyd's requisition for testing anchors and cables; and as the port of Sunderland will be unprovided with testing machines by the 1st of next January—the date when Lloyd's extended regulation will take effect—all the Sunderland chains and anchors will have to be sent from the Wear to the Tyne to be tested. The Newcastle people will thus at once benefit by the shortgoings of their less far-seeing neighbours, to the injury of the Sunderland chain manufacture.

The delay in the Public Compulsory Act will thus be scarcely of any great consequence, as, by the time it is passed next Session, private enterprise will have made complete preparations for its reception. Most of the above companies are being formed, under the auspices of Lloyd's, by their engineer at Poplar—Mr. T. M. Gladstone.

PETROLEUM GAS.

The following report is from Mr. George Bower, of Huntingdonshire, gas contractor to the Duke of Marlborough, the Earl of Shrewsbury, Viscount Hill, &c.:—

Having had a large quantity of crude petroleum oil placed at my disposal by Mr. A. S. Macrae, of Liverpool, for the purpose of ascertaining its gas-yielding properties, and also whether it could be used along with common coal, wood, or peat, for the purpose of enriching the gases made from these substances, so as to compete with boghead, which is the material now generally used, I am now enabled to make the following observations:—

Before giving the results of the experiments, I think it right to describe the apparatus which I have constructed purposely for these experiments.

The retort is double-acting, 4 ft. long, and of this shape in section Ȣ, and known as the Fitzmaurice retort, the principle being that of the regenerative system, as practised by Malam some 40 years ago, but with this difference of construction—Malam had two retorts, a large and a small one, set one over the other, the coal being placed in the large retort in the bottom, the vapours passed through the smaller one at the top, and those which were not permanently gaseous were made so by their passage through this highly-heated surface.

Although by this process the yield of gas was increased per ton of coals distilled, yet it was at the cost of both the illuminating power, wear and tear, and fuel—in short, the cost was greater than the value of the larger product, and so did not obtain extensive use. This system was applied to coal gas, which of itself has only a moderately illuminating power; and though some of the tarry vapours were arrested, yet the second application of heat to the already formed gas deteriorated its illuminating properties, by causing it to deposit carbon, and thus more than counterbalanced the advantage of an increased yield. The evolution of gas from coal in an ordinary retort is a slow and gradual operation, the outside being first acted upon; and hence it requires six hours to obtain the whole of the gas from 1½ cwt. of coal, with which the generality of retorts are charged; but with oil the vapour is evolved so rapidly, that without a considerable surface for it to pass over, a very great portion of it would be condensed into a thin, black, tarry oil; hence the advantage of the Fitzmaurice retort, which is also equally adapted for coal, wood, or peat, and the gases from which can be enriched with oil.

It has been a common practice, in making gas from oil, to fill retorts with coke, broken bricks, or any material which will give surface, and the oil has been dropped or run into them, or made to traverse through them; but this seems to be a very effective way of absorbing the carbon, to which all gas owes its luminiferous property. The result of a great number of experiments has made me determine that a high heat, with a large surface, is the very worst plan that can be adopted for making gas from oil; but that in order to get the best results, a moderate heat—dull cherry-red by daylight—and the double form of retort without anything in it, give the best results, not for volume of gas, but for quantity of light; in other words, there is more light from 80 cubic feet of gas produced in accordance with the latter plan from the gallon of oil, than from 160 ft. produced according to the former made from the same quantity.

The test of the apparatus is the same as for ordinary coal, excepting that no purifier is required; but the condenser has double the surface of that for coal, on account of the rapidity with which the gas is evolved. A meter to measure the quantity of gas produced, and a gas-holder, complete the apparatus.

Two qualities of oil were supplied to me by Mr. Macrae, one of specific gravity ·805, the other ·910; water being 1.

It may be stated that the higher the specific gravity of the oil the better the yield of gas, and the heavier it is the greater the heat required to get the best results.

I now proceed to consider the cost of gas from petroleum oil, and how far it may be used for this purpose.

The present price of the lighter of the two oils is about 1s. per gallon. I will dismiss the heavy oil, and confine my remarks to that of specific gravity ·805, as it is, upon the whole, more economical to use than the other.

With the present prices of oil the gas cannot be other than very costly, when compared by volume alone against ordinary coal gas; but when all the collateral advantages are taken into consideration, and a comparison instituted upon the basis of quantity of light from equal volumes, then the contrast is not so marked.

The advantages which oil has over coal are in the fact, that it requires no purification, being absolutely free from impurities; hence it may be used in the most sumptuously decorated saloon, library, or picture gallery, without the slightest fear of its injuring anything whatever; the process of making the gas is much more simple, the apparatus to produce an equal quantity of light as that from coal is much less costly, and consequently the wear and tear is also less; and not only is a less quantity required for an equal amount of light, but the heat is considerably less than coal gas.

If the comparison be made as between coal and oil, coal undoubtedly makes the cheaper light by far; but, if it be instituted as between tallow and oil, as ordinarily burnt in lamps, then the light from petroleum oil gas is very much less costly than from either of them.

One ton of oil will produce as much gas as will give the light of that produced from good Newcastle coal; thus where carriage forms the chief item of the cost of the material at its destination, oil may, in such a case, enter into favourable competition with coal; or, where the first consideration is purity, and to have a gas which, for light, shall be more brilliant and powerful than the oil burnt in the solar and moderator lamps, then not only is petroleum superior, but also of considerably less cost.

His Royal Highness the late Prince Consort took great interest in portable gas, and I have in my possession a vase which he had made especially for his own use to contain compressed oil gas. One foot of oil gas will give the light of three feet of ordinary coal gas, and though gas under very high pressure, loses some of its luminous qualities, yet it may be condensed at fifteen atmospheres, and thus become perfectly portable; so that beginning with a gas of three or four times the illuminating power of common coal gas, and condensing a given volume into a fifteenth of its bulk, there is in this fact alone a large field for the use of oil gas for the lighting of railway trains, ships, private carriages, and country houses, where it may not be feasible or policy to erect small gasworks for the supply of gas at ordinary pressures. For instance, the Albert vase already alluded to is of a capacity equal to half a cubic foot, and if charged with oil gas compressed to fifteen atmospheres, it will then deliver 7 ft. and as this is, to begin with, three times more powerful than common gas, its effect will be equal to 21 ft., and will give a light equal to six or eight candles for seven hours.

The daily cost of petroleum oil gas, when made to supply one hundred lights burning for six hours, each light being equal to eight candles, is as follows:—

	£	s.	d.
15 gallons of oil, 1s.	0	15	0
Coke to heat the retorts, 3 cwt., 1s. .	0	3	0
Labour—part of a lad or man's time .	0	1	6
Wear and tear	0	0	9
Interest on capital	0	0	4
Fund to maintain plant in perpetuity .	0	0	6
Net cost of 1,200 cubic feet .	£1	1	1

This is about five times what coal gas would cost on the same scale; but as the illuminating qualities of the 1,200 cubic feet are equal to about 3,500 of ordinary coal gas, the oil does not compare very unfavourably when everything is taken into consideration, so that if the gas be required only for lighting purposes, and not for cooking or heating (for which it is totally inapplicable), then there are very many who will doubtless prefer paying a high price for oil gas, in order to get a light which is absolutely pure, and which, though not nearly so cheap as ordinary coal gas, is nevertheless infinitely cheaper than oil, tallow, or wax, as ordinarily burnt, and without their inconveniences.

The supply of oil in Pennsylvania and Canada, in Moldavia and Wallachia, is practically exhaustless; and as a means of transport to the shipping ports are increased, so probably will the price be reduced, though every day almost is adding a new product obtainable from it, so that it may be some time before the price will be materially reduced.

PRESERVATION OF IRON-PLATED AND OTHER SHIPS.

A process has been invented by Monsieur Jean Pierre Jouvin, Chief Medical Officer of the French Navy, and Professor of Chemistry to the Naval School of Medicine at Rochefort, "for preserving

Iron-plated and other Vessels and Metallic Articles from Oxidation, and Preventing Ships' Bottoms from Fouling." The French Government are now making trial of the process by covering two iron-clad vessels with the preparation.

The invention has been patented in England, and consists (as described by the inventor) in lining the inner surface of ships' sides and bottoms, perfectly scoured, with sheets or lamina of zinc applied directly against the sheet-iron, and there held fast between the latter and the frames. But as iron ships now afloat present some difficulty to the application of such zinc sheathing in the interior of their holds, the internal sides of the hold are first carefully scoured, and afterwards a double coat of a paint made of powdered metallic zinc is applied thereon, which is spread all over from the keel up to a little above the water line. As zinc paint, on account of the fatty matter it contains, does not act as an electric protector with the same efficiency as zinc when employed in the form of sheets, it is necessary to increase the area of the protecting surface.

For iron ships on the stocks, as soon as the keel, the stem, the stern-post, and frame are set up, they receive a thick layer of the aforesaid metallic zinc paint. The boarding of the keel and sides is afterwards proceeded with as usual, care being taken to apply underneath the timber employed a coat of the same paint, or in lieu thereof sheets of greasy felt thickly sprinkled with powdered metallic zinc. The zinc sheets are then applied without difficulty, and become bound with the sheets of iron of the streaks from the keel up to the water-line, and from the stem up to the stern-post, so as to form part with them. The sheets of zinc are held between the sheets of iron which form the stem and the keel, and, assuming the shape of the sheets to be protected, form continuous bands extending right and left and from the bottom upwards, so as to meet and join each other, between the sheet-iron forming the stern-post, and to have their ends in the vicinity of the helm and the water-line. As the riveting takes place at a temperature higher than that of the melting of zinc, and approaching that at which this metal evaporates, part of the sheets around the heads of the rivets would be destroyed; to avoid this defect, the sheets of zinc must be of sufficient breadth and length to cover the sheet-iron to within one-third of an inch of the rivets, without reaching them. The phenomena of dilation could, therefore, freely take place on the preserving plates, the co-efficient of expansibility of these plates being nearly double that of iron.

For those parts of the zinc plates held between the frames and the sheet-iron, in order to ensure a complete riveting of iron on iron, it is necessary to begin by cutting washers or discs, by the ordinary means, in these bands opposite each hole of the rivets. The diameter of these washers must be double that of the rivets, and they are finally replaced by rings of sheet-iron, the diameter and thickness being equal to that of the bands of zinc. The covering bands and the heads of the rivets must receive a thick coat of metallic zinc paint. In the electro-chemical scale, the protecting metal (zinc) coming immediately after the protected metal (iron), it will be advantageous to have the protecting surface as nearly as possible of the same dimensions as those of the surface to be protected. It is found that the protecting bands of zinc, if properly fixed from the keel up to the water-line, may be about two-thirds at maximum, and about one-tenth at minimum of the last surface, provided all the spaces between the zinc bands be covered with the metallic zinc paint. The zinc sheets should measure about one-fourteenth of an inch in thickness for the lower part, and about one-twenty-eighth of an inch for the sides of the hold. When the ship is built, all the parts of iron composing the hold—such as the ribs, keelsons, clamps, transversal bulk-heads, and others not covered by the zinc bands, are carefully scoured, brushed, or otherwise cleaned, and then coated with metallic zinc paint.

To protect the exterior part of the hull immersed from the deposit of marine shells and plants, the inventor proceeds as follows:—He states that turbith mineral (SO^3 $3HgO$) mixed with Prussian blue ($3Fe$ Cy + $2Fe^2$ Cy^3) produces by its contact with the alkaline chlorides of sea-water, one of the most violent poisons known to mineral chemistry, namely—the cyanide of mercury (Hy Cy) in the shape of chlorocyannide of mercury and sodium. He, therefore, first mixes fifty-five parts of turbith mineral with forty-five parts of Prussian blue of the commonest tint, but not adulterated, so as to obtain green powder perfectly homogeneous, and composes the poisonous paint as follows:—Of boiled linseed oil 250 parts; red lead (or any other agent which may cover or adhere as well or better than red lead), which is here used as a mere vehicle for the poisonous compound, 650 to 660 parts; the hereinbefore described mixture 90 to 100 parts. These substances must be well ground together in order to effect a uniform and complete distribution of the poisonous compound throughout the mass of the paint. But as iron possesses the property of reducing mercurial and leaden compounds, this preparation must not be applied direct on the bare metal, all the parts of the hull—namely, the sheet-iron of the keel, cut-water, rudder, paddle-wheel frames, and every part of iron to be immersed or wetted—must be previously coated with two layers of the metallic zinc paint, after being scoured as completely as possible. When these layers of metallic zinc paint are quite dry, the poisonous compound or paint is applied thereon. This poisonous compound may prove also very advantageous if applied to wood employed to secure dikes, embankments, and for marine constructions, to protect them from injury by teredos. The smallest particle of the chloro-cyanide of mercury and sodium produced by its contact with sea salt, suffices to kill instantaneously animalculæ, plants, and even their germs when brought within its influence.

To apply the invention to iron-plated vessels, there must either be placed between the woodwork of the hull and each iron plate a sheet of zinc, the surface of which is rather smaller than that of the iron plate, or this woodwork must be first coated with a thick layer of metallic zinc paint; then each iron plate, previously well scoured, is similarly painted on its inner face, and adapted to the sides of the ship. The ship being finished, the whole of her bottom to be immersed in water is treated in the manner before described—that is to say, first coated with a double layer of metallic zinc paint, and afterwards with the poisonous compound paint. To preserve sheet iron tanks, marine boilers, steam engines, and other similar articles from oxidation, the inventor either applies on them externally zinc sheets, or coats them with a double layer of the afore-mentioned metallic zinc paint.

To preserve the parts of cables and chains stored in wells, where they are oxidized very rapidly, a band of zinc is fastened by screws on each of the rings or links. The metallic zinc paint may be applied to iron articles in general, wherever red paint is now made use of, and as a substitute for it. For ships' bottoms with a copper sheathing, before the sheathing is applied the woodwork is coated over with a thick layer of metallic zinc paint. But in the present case it is more economical to employ powdered cast iron, or, in preference, iron powder, instead of zinc powder, to prepare the metallic protecting paint, as it will protect copper as effectually. Should it be found, however, that the copper sheathing gets foul with barnacles and sea-weeds, it must be coated with the poisonous compound before-mentioned.

HINTS ON PAPER MATERIALS.

In searching for fibre suited for the manufacture of paper, the following hints may be found useful to residents in tropical and other regions.

Any fibre capable of cohesion when precipitated on a draining surface from mechanical suspension in water, after having been reduced to a pure state of capillary subdivision by mechanical action, is fit for the manufacture of paper.

For all practical purposes it may be accepted as a rule, that for the manufacture of white paper all fibre requires bleaching.

Raw fibre may be divided into four classes:—

1. That which is easily reduced and easily bleached.

2. That which is easily reduced, but difficult to bleach.

3. That which is difficult to reduce, but easily bleached.

4. That wherein perfect bleaching involves the integrity of the fibre.

The most profitable shape in which to send fibre to the English market is that of half-stuff (or pulp). Well-prepared bleached half-stuff would fetch £25 per ton in the market.

The best machine for reducing fibre to half-stuff is the ordinary rag-engine, costing about £150, carrying about 2 cwt. of stuff, and requiring a maximum of 7-horse power for driving. The half-stuff would require to be pressed, dried, and packed in bales. For experimental purposes in reducing the fibre, anything smaller than the ordinary sized rag-engine is useless, as the weight of the triturating roll—about 15 cwt.—cannot be dispensed with, so that laboratory experiments are necessarily confined to rough separation and bleaching. Moreover, laboratory experiments, unless conducted with the utmost care and skill, furnish no reliable data for commercial operations. As a preliminary, the character of the fibre ought to be determined in the laboratory—

1st. In relation to its structure, having in view ease in fibrous separation. 2nd. In relation to its chemical constitution, having in view ease in bleaching.

Bleached half-stuff would realize a larger profit than unbleached, always supposing that the process of bleaching, owing to the accident of geographical position or otherwise, did not entail expense extra to that properly belonging to the operation under the most favourable circumstances.

Fibre could be sent into the market as half-stuff unbleached whenever its characteristics were reliably established. B. L.

THE TELEGRAPH TO INDIA.

If mechanical appliances are to be depended upon, and if the most careful and experienced supervision of all relating to the scientific perfection of a submarine cable is of any avail, the whole of England before next March will have at command a means of daily, if not hourly, communication with Madras, Calcutta, and Bombay. The activity of gray shirtings or the dulness of mule twist ought to be known here to the fraction of an anna every morning; and the news from China and Australia anticipated by exactly the difference of time between an overland passage and an overland telegraph, which means the difference between thirty days and five hours. So carefully have the plans been matured, so quietly has the cable itself been manufactured, that the announcement that the expedition will in a few days begin to leave these shores to accomplish such great results, comes upon us with a suddenness that is almost startling, and the notion of being in instantaneous communication with all India soon after Christmas seems almost too good and too astounding to be capable of such immediate realization. Such, however, is at least the object with which the expedition will start, and such, we have not the slightest doubt, is the object which it will accomplish with triumphant success. The Indian Government in making their cable have proceeded so quietly that, except a few electricians and scientific men, the announcement that a cable to connect this country with Calcutta is nearly made will, we fancy, be quite a surprise to our readers.

The political necessity which renders it essential for Her Majesty's Government to be in frequent communication with the great Indian Empire, it is needless here to describe. The Government of such distant possessions as India and Australia can scarcely be carried on in the bureaus of Downing-street without some readier means of conveying instruction than that afforded by the post. Ministers have long been conscious of this fact; and the failure of the attempt to establish electric communication with India *via* the Red Sea, must be fresh in the memory of all. Profiting by the bitter experiences of that unfortunate undertaking, the Government have wisely determined to take the construction and completion of the present line to India into their

own hands. The India Board have placed the general superintendence and control of the line under Lieutenant-Colonel Patrick Stewart, R.E., an officer as well known for his gallantry during the Indian mutiny as for the great services he rendered the Government by the construction and maintenance of the telegraph lines through the wildest districts of Central and East India. For the immediate electrical and engineering superintendence of the line, and also for the arduous task of submerging it, the Indian Government have selected Sir Charles Bright and Mr. Latimer Clark, and under such auspices and supervision its manufacture is now approaching completion at Mr. Henley's telegraph works, North Woolwich. Whatever may be its ultimate fate, it is quite certain that there never yet has been a cable manufactured with such care, or one which, in point of "conductivity" and insulation, comes so nearly up to the standard of absolute electrical perfection. The design and construction of the cable differ very materially from any line hitherto laid. Every operation in submarine telegraphy—even the great Atlantic line—has contributed its quota of valuable experience; for, though successfully laid by Sir Charles Bright and his assistant engineers, in spite of its imperfect construction, it was destroyed by the injudicious electrical treatment it received after submersion. This fact is now so well established, that the cause of the failure of the Atlantic cable may be considered as at rest for ever. The insulation of that line was not very perfect, as may be imagined from the infancy of the science at the time, but yet the electrical power used was such as would infallibly break down even the most perfect cables manufactured at the present day. Of this our readers may judge, when it is stated that the large induction coils first used in signalling between England and America were probably equal in electrical power to 2,000 battery cells, while now it is found inexpedient to use more than two or three cells in working the longest submarine lines in existence. Some of this great power was no doubt used in the vain hope of forcing signals through the line at a greater speed than the very slow and unremunerative rate at which it has alone been found possible to communicate through an unbroken length of 3,000 miles. The result was disastrous, but the experience, though dearly bought, has proved of great value. It has taught electricians the value of moderating the power used in working lines, and, above all, has pointed out the imperative necessity of having no single section of a submarine line of more than 600 miles in length. To lay long submarine cables in a continuous length without intermediate stations has been found to answer no other purpose than that of greatly diminishing the speed of working, and multiplying every imaginable risk both of manufacture and submersion. The Indian Government, acting under the judicious counsel of their scientific advisers, have wisely determined to divide the Persian Gulf cable into three sections, though its total length will not exceed 1,500 statute miles.

The faults which led to the destruction of the Red Sea line were of another character. Though it was manufactured and tested with a care greatly superior to that taken with the Atlantic cable, it was submerged in a way which rendered its ceasing to work a question of a few weeks more or less. Sheathed in a covering of small wires, quite unprotected from corrosion, it was laid without any allowance for "slack" cable to fall into the irregularity of the bottom of the sea. It consequently lay strained across the points of the inequalities, with a tension of several thousand pounds. As the unprotected wires rusted away, and the suspended portions of the line became loaded with coral and barnacles, the whole line crumbled into hundreds of pieces by its own weight. This is no mere hypothetical opinion, but a fact, which was amply proved by the expedition to the Red Sea in 1861, under Mr. Latimer Clark. There can be little doubt that the same cause led to the temporary failure of the Malta and Alexandria line, as well as that laid for the French Government between Toulon and Algiers.

To obviate this cause of danger, which, in the above-mentioned lines, has probably occasioned a loss of property to the value of over a million sterling, the Persian Gulf line is cased in twelve No. 7 gauge hard-drawn iron wires, thickly galvanized, so as effectually to prevent their corrosion. But, in order to secure more effectually the permanent stability of the line, the whole finished cable is thickly coated with two servings of tarred hemp yarn, overlaid with two coatings of a patent composition invented by Sir Charles Bright and Mr. Latimer Clark. The composition consists of mineral pitch or asphalte, Stockholm tar, and powdered silica, mixed in certain proportions, and laid on in a melted state. While yet warm it is passed between circular rollers, which give it a round, smooth surface. When quite cold this forms a massive covering of great strength and perfect flexibility, totally impervious to water, and incapable of being destroyed by the minute animalculæ which exist in such abundance in warm latitudes, and which, when the cable is not protected against their attacks, eat every atom of the hemp, as in the case of the cable laid between Toulon and Algiers. Galvanising the wire is in itself an almost perfect protection from rust—certainly for many years, as the good condition of the cable picked up off the Kooria Mooria Islands, a part of which was galvanised, showed, as far as the galvanising was concerned. But, with the final protection both from rust and animalculæ which Bright and Clark's compound affords, there appears to be no reason why this cable, when once laid in shallow or deep waters, should not remain good for a hundred years to come. The copper conducting wire is composed of four segments, drawn into a hollow tube in such a manner as to appear like a solid wire. By this means all the advantages of a strand wire are combined with the condensed bulk and small surface of a solid one. The copper from which the wire is drawn is especially selected by the engineers for its high capacity for conducting electricity. It is, perhaps, not generally known that different samples of copper vary as much as 50 or 60 per cent. in this respect—that is, some specimens of copper wire will conduct electricity with greater facility than other specimens of double the thickness, though physically there may not be the slightest difference by which you can distinguish one from the other. This wire, which is nearly one-eight of an inch in diameter, is then covered by the Gutta Percha Company with four distinct coats of gutta percha, and four coats of Chatterton's compound, laid on alternately. This "core," as it is termed, is then tested in cold water, at a temperature of 90 deg., and then under a pressure of 600 lb. to the square inch. After passing through all these ordeals, the loss by leakage through the gutta-percha covering does not exceed one-hundred-millionth part of the current of electricity passing through the conducting wire in every nautical mile. To such minute perfection has the system of testing adopted by the engineers been carried, that the loss of one-thousand-millionth part of the current by leakage could be detected and estimated on the instruments. In the present state of the insulation of the cable the loss by leakage in working each section of the line will not exceed one-four-hundredth part of the electric current sent through the conductor—a condition of insulation which we believe has never been equalled by any cable hitherto manufactured.

Before being sheathed at Mr. Henley's works the coils of gutta-percha core, which are in three-mile lengths, are again tested under water for insulation and for resistance of conductor, therefore if any injury should have occurred to the fragile gutta-percha covering of the wire during its transit from the Wharf-road to North Woolwich it is detected before the cable is made up, and then the process of sheathing them in their outer covering is commenced. The first coating outside the gutta percha is twelve thick strands of wet hemp, and over these again come twelve solid No. 7 gauge wires, which have been most carefully galvanised by Mr. Henley. The outer covering of iron wire is generally the last which a cable receives, but in this instance, as the line is to be laid in comparatively shallow water, the wires themselves, though galvanized, are to be still further protected from their most formidable enemy, rust, which is done by the coverings of Bright and Clark's composition already described.

During the whole time the cable is at Henley's the current is kept always through it, so that the slightest possible defect in the wire can be detected. In addition to this the very able electrical staff test every portion regularly twice a day for insulation and resistance of conductor. When everything has been done which the most jealous care and the most fastidious scientific skill can suggest, it is passed out on the river side of Mr. Henley's factory and coiled away in tanks filled with water; and even here perpetually watched and tested. There are upwards of 900 nautical miles of it thus manufactured lying at Mr. Henley's works—huge coils of thick black-looking rope, nearly 1¼ in. in diameter, weighing nearly 4 tons to the mile, and 2½ tons in water, and costing as nearly as possible £200 p[illegible] mile—the cheapest, strongest [illegible], electric[illegible] speaking, the most perfect [illegible] is ever [illegible] been made. Three hund[illegible] [illegible] of the same kind have ye[illegible] [illegible] which, however, the gre[illegible] factory are quite equal—in the time that yet intervenes before the last ship which composes the expedition will leave this country in September. We have hitherto spoken of this cable as the Indian wire, but, strictly speaking, it ought to be called the Persian Gulf line, and it is down that route it is to be laid to connect Kurrachee with the present land line to Constantinople. Colonel Stewart has himself during two years travelled through and examined the various overland routes which have been from time to time suggested for a part of this line across the Turkish portions of Asia Minor. One of these has been selected from the greater ease with which land lines are erected and kept in repair as compared with submarine wires, and also because along at least three-fourths of the entire route the Turkish Government have already established, and keep in admirable working order, a telegraph from Constantinople to Bagdad. This land line runs from Scutari on the Bosphorous across Asia Minor to Diarbekir, thence to Mosul (the ancient Nineveh), and thence to Bagdad. It happens, however, that over the broad tract of country which intervenes between Bagdad and the head of the Persian Gulf, along which this submarine cable to India is to be laid, various predatory tribes of Arabs claim a sovereignty, and fight for it with more or less success, and over these lawless vagabonds of the desert the Porte has no manner of control. Always quarrelling among themselves, they agree only on the one point of disobeying and defying their nominal lord, the Sultan, which they always do with impunity at least, if not success. These people will require skilful handling, and the land line from Bagdad will probably be taken along the frontiers of Arabia, through the territories of the most powerful of the tribes, who are able to protect it against all comers, and whom a subsidy of £1,000 a-year will at once render most zealous. By this route, for a length of some 300 miles, it will pass to the head of the Persian Gulf at the estuary which marks the junction of the Tigris and Euphrates—a miserable Eastern township, called Shat-el-Arab.

It is not intended, however, to rely solely upon this land route. Another land line will very probably be taken from Bagdad over the frontier of Persia to Teheran, thence to Ispahan, and so on by Shiraz down to the shore of the Persian Gulf at Bushire. Thus, even in the case of the Arabs proving refractory, there will always be the land line through Persia to Bagdad, and so on to Constantinople and England. From the estuary at Shat-el-Arab the submarine portion of the line is to be laid in three sections; for, though the length of the whole is only 1,250 nautical miles, yet the Government have most wisely determined to avoid the fatal dangers which always beset telegraphy through long deep-sea routes by making no less than three breaks at the stations at which the cable will be landed. The first length will be from the head of the Persian Gulf at Shat-el-Arab to Bushire, a distance of 170 miles, along which the cable will be submerged in from 20 to 25 fathoms of water. The next length will be from Bushire to Mussendom, a bold, desolate, stony headland on the coast of Arabia. This section will be 440 miles long, and submerged in from 30 to 35 fathoms of water. The third length will be from Mussendom to Guaddel, a small city on the Mekran coast, on the frontier of the Kelat territory. This portion will be 400 miles long, and laid in from 40 to 50 fathoms of water. From Guaddel, a short length of land line is now almost complete along the coast, giving direct communication with Kurrachee, and thence all over India to the very frontiers of Burmah.

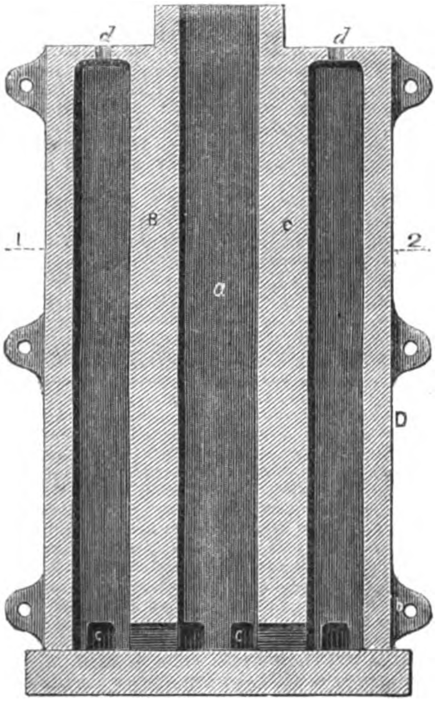
At all these breaks or stations in the Persian Gulf the extreme shore ends will be very massive, coated with galvanized iron wire of almost tenfold strength, and weighing as much as eight tons a mile. In certain portions of the route near Bussorah, where there is any danger to be apprehended from small coasters anchoring, the weight of the line will also be increased by the extra thickness of its wires to nearly nine tons a mile—enough to shield it from any risk from the little anchors of the native boats which are likely to come there. In short, as far as depends on minute care and a wide scientific experience, the whole cable is likely to be as perfect as skill or ingenuity can make it. The vessels which are to take this line will probably leave England ab[illegible] end of next month, arriving on the scene [illegible] [illegible]tions in the Persian Gulf in January [illegible] [illegible]he best time of year in which to lay [illegible] process of submerging it and [illegible] [illegible]nds is not likely to occupy more [illegible]. The total cost of the sub[illegible] [illegible] line will be less than £350,000 [illegible] [illegible]f laying it.—*Times.*

JOHNSON'S IMPROVEMENTS IN INGOT MOULDS.

THE following invention for improvements in ingot moulds, has been recently patented by Mr. J. H. Johnson, of 47, Lincoln's-inn-fields, Middlesex. The invention relates to a peculiar construction and arrangement of moulds to be employed in the casting of ingots of steel or other metals, and consists in making such moulds syphon-shaped, the metal being first poured into a main compartment, which communicates at its lower end only with one or more other compartments by a lateral aperture or apertures, the metal rising in such other compartments slowly and steadily, although poured rapidly into the main or filling compartment. Each of the compartments in connection with the main compartment is closed at the top with the exception of a small aperture for the escape of the air and gases. Any number of these compartments may be combined together in one apparatus, which is composed of several parts held together by bolts and keys, or otherwise, so as to be readily separated for the purpose of opening the several moulds when the ingots are to be removed.

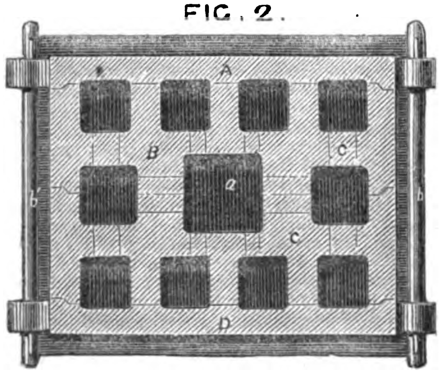
Fig. 1 of the accompanying drawings repre-

FIG. 1.



sents a vertical section, taken through the centre of the improved mould; fig. 2 is a horizontal

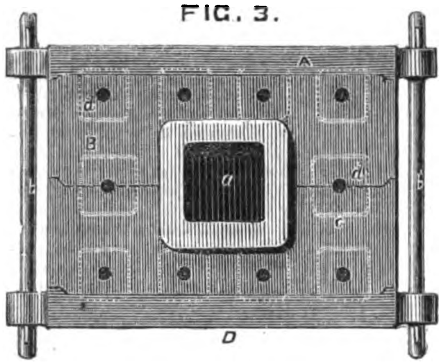
FIG. 2.



section of the same, taken along the line 1, 2; and fig. 3 is a plan of the top of the mould.

This mould is composed of four parts, A, B, C, and D, held together firmly by the key-bolts, b, b¹, and comprises eleven distinct compartments or chambers, the whole of the ten chambers which surround the larger central or main chamber *a* communicating with that chamber at their lower extremities by the openings or passages *c*, *c*. The upper ends of the smaller chambers are closed, with the exception of a small vent hole *d* left therein. The entire mould is made to open or separate into four parts, in such a way that after the ingots have been cast they can all be easily removed from their respective

FIG. 3.



chambers, the lines of division being made to pass through the whole of such chambers, as shown in the drawings.

In using this mould, its parts are first bolted together, as shown, and it is then placed on end upon a flat plate or block of metal (see fig. 1). The molten metal is then poured rapidly into the mouth of the central or main chamber *a*, and rises slowly in all the other chambers, entering therein by the openings *c* at the bottom. As the central chamber rises a little higher than the rest, a slight pressure will be exerted upon the metal in the surrounding compartments, and one mouth alone requires to be covered—namely, that of the compartment or main chamber *a*. When set it is simply requisite to draw out the key and withdraw the bolts, when the mould can be opened, and the several ingots removed. It is obvious that the moulds might be modified in form and number, and in the means adopted for holding the parts together without departing from the nature of this invention.

GAS FROM CANNEL AND FROM COAL.

THE following analysis of the comparative value of gas made from coals and cannel is by Dr. Andrew Fife, Professor of Chemistry, King's College, Aberdeen:—

A ton of English caking coal yields, on an average, at gas-works, 8,000 feet of gas; and though a larger quantity was given with my apparatus, yet we must take 8,000 as the quantity on a large scale. The value of the coal is taken as 1.

The Wigan cannel yielded 9,500 and 11,500; the value of the gas, bulk for bulk, being the same, viz., 1·85 to the former as 1. Now, taking into account the quantity of gas afforded, the value of the coals for yielding light, by the consumption of their gases, is as 2·23 for the one quantity, and ·25 for the other. Taking the average, we state the value of English cannel coal as 2·35, or say 2½ to Newcastle coal as 1.

The following analysis of the cannel raised by the Ince Hall Coal and Cannel Company, is by Mr. John Leigh, M.R.C.I., Consulting Chemist to the Manchester Corporation Gas-works:—

Carbonic oxide and aqueous vapour	1·53
Olefiant gas and divers hydro-carbons	8·50
Atmospheric air	4·32
Nitrogen	0·19
Hydrogen	40·30
Light carburetted hydrogen	33.83
Carbonic acid	11.35
	100·02

Quantity of gas produced ... 11·673 cubic feet.
Specific gravity of gas... ... 5·20 ,,
Coke produced from 1 ton of cannel, 13 cwt. 0 qrs. 13 lb.

This cannel is used by the chief gas-works of this country, including London, Liverpool, Manchester, and Birmingham; and by the principal foreign gas-works, both on the Continent and in North and South America.

The analysis of the same Company's gas coal, made by Mr. J. E. Clift, Engineer to the Pagoda Gas-works, Birmingham, gives:—

Carbon, from 100 parts	84·50
Hydrogen ,,	5·14
Oxygen ,,	2·10
Nitrogen, ,,	2·20
Sulphur, ,,	0·33
Ash, ,,	4·12
	98·39
Loss	1.61
	100·00

Products obtained from one ton of gas coal, being the average results obtained from using 300 tons in making gas:—

Gas produced, 10,200 cubic feet; illuminating power—one Argand burner consuming five feet per hour—thirteen spermaceti candles of six to the pound; specific gravity, 462; atmospheric air being 1·00. Coke produced, 13 cwt. 3 qrs., or 44 imperial bushels; suitable for ironfounders, brassfounders, and maltsters. Ammoniacal liquor produced, 20 gallons; 1 gallon requiring 10 oz. of the sulphuric acid of commerce to saturate it. Tar produced, 10 gallons.

Purification of the gas:—1,000 cubic feet of gas requires 12½ lb. of lime for its purification, which shows it to be comparatively very free from sulphur.

The other impurities of coal gas are not more abundant than in that made from other coals.

A further analysis of the same Company's gas coal, made by Professor Thompson of London, gives:—

Specific gravity	1·270
Coke, per cent.	65·2
Volatile matter, per cent.	34·8
Cubic feet of gas, per ton, gross	11,400·
,, ,, ,, purified	11,200·
Impurity per cent. in gas	1·8
Specific gravity of purified gas	406·
Illuminating matter condensible by bromine, per cent.	4·25
Carbonic oxide in purified gas, per cent.	4·

Illuminating power of the gas, burnt at 5 ft. per hour, equal to 13·8 spermaceti candles, each consuming 120 grains per hour.

Heating power of the coal:—1 lb. will convert 15½ lb. of boiling water into steam.

GREAT BLOWING ENGINE.

THE following description of one of the largest blowing engines in America cannot fail to prove interesting to many of our readers. We extract it from the Philadelphia *Engineer*. The engine was erected in the latter part of the year 1860, and has, we believe, proved perfectly successful:—

The pressure at which our large blast furnaces are blown has been generally increased from 2½ lb. up to 10 lb. to the square inch; and some of the largest furnaces in the world are now working at the latter pressure, and running off the enormous quantity of 280 tons of pigs weekly. The efficiency of a blowing engine is not, therefore, exactly in proportion to the size of its blowing cylinder, since, at the high-blast pressures, which now prevail, a given quantity of air is rendered more effective for the purposes of the furnace than a larger quantity admitted, as formerly at 2½ lb. pressure. The largest blowing engine in the world, so far as mere bulk is concerned, is one at the Dowlais Ironworks, in South Wales. It has a 55 in. steam-cylinder, with a stroke of piston of 13 ft., while the blowing cylinder is of the enormous diameter of 12 ft., the stroke being also 12 ft., or 1 ft. less than the stroke of the steam piston. The beam, which is centered unequally, to allow for this difference in stroke, is 40 ft. between end centres. The six boilers have 8,414 square feet of heating surface. The next largest blowing engine of which we have any knowledge is that of Mount Savage, Maryland, and built at the West Point Foundry. This has a steam cylinder 56 in. in diameter, and a stroke of piston of 10 ft., the blowing cylinder being of 126 in. bore (10 ft. 6 in.), and 10 ft. stroke. This

engine was intended to work with steam of 60 lb. cut off at one-fourth stroke. From what we have heard of it, we judge that its performances have not been altogether satisfactory. The most *powerful* blowing engines yet made have been constructed by Messrs. I. P. Morris and Co. of this city; and these makers have obtained a reputation for the construction of machinery of this class, not inferior to that of Harvey (of Cornwall, England), for the construction of pumping engines, Whitworth, of Manchester, England, or Sellers, of Philadelphia, for the construction of machine tools, nor to that of Baldwin or Rogers for the construction of locomotives. Messrs. Morris and Co. have made several very large blowing engines for the Lehigh Crane, Thomas, Scranton, and other iron companies: one pair for the latter company having 110-in. blowing cylinders, with 10 ft. stroke. These, however, have been removed, since the great increase in the pressure of the blast, and smaller blast pistons are now worked with the same steam power.

An engine, the 500th made by these builders, has been constructed at their works at Port Richmond, in this city; and for combined size and power it surpasses anything yet attempted in the construction of such machinery. It is one of a pair erected at two new furnaces building by the Thomas Iron Company at Hockendoqua, Lehigh county, in this State. The furnaces are 18 ft. in the boshes and 60 ft. high, and are expected to run off 300 tons of iron a week. Messrs. Morris have introduced a plan of blowing engine corresponding to the Bull engine used for pumping the steam, and blowing cylinders being placed in the same vertical line, with both the blast and steam pistons on the same rod. Notwithstanding the economy and excellent success of this arrangement, the Thomas Iron Company have chosen to incur the expense of a beam engine. So far as structural grandeur is concerned this choice is not to be regretted, although we doubt if it can be justified upon any grounds of mechanical expediency. The engine, upon the plans completed by Messrs. Morris' draughtsman, Mr. Davis, is, therefore, of the following general plan and dimensions. The piston rod of the upright steam cylinder, which is 66 in. in diameter, has a stroke of 10 ft., and is connected to one end of a beam (made in pairs), 30 ft. 10 in. between centres. The blowing cylinder, the piston of which has 10 ft. stroke also, is 108 in. in diameter. At the steam-end of the beam it is prolonged 3 ft. 1 in., and a pin for the attachment, on each side, of a connecting rod, is inserted at a distance of 18 ft. 6 in. from the main centre. The fly-wheel shaft is supported in boxes on the bed plate of the engine, in front of the cylinder and steam chests, and but a few inches above the stone foundation. The air-pump, condenser, &c., are placed below in the usual manner. The boilers for supplying steam for this engine are heated by the waste gases from the blast furnace. There are 6 boilers, each 3 ft. in diameter and 80 ft. long; and beneath each one and connected with it is a smaller boiler, or "heater" as it is called, 2 ft. in diameter and 60 ft. long. As the waste gases are more than sufficient for the production of all necessary steam, it is worked at full stroke, no economy being attempted by working expansively. The working pressure in the boilers is 50 lb.; and with the vacuum obtained by condensation, the effective pressure on the piston will probably be 55 lb. to the square inch. The engine is expected to make 20 double strokes a minute, equal to a speed of piston of 400 ft. per minute, and assuming an effective pressure and vacuum, at this speed, of 50 lb., the power actually exerted including that expended on the friction of the engine, would exceed 2,000 horses.

The whole engine sits on a heavy bed-plate, which rests on stone masonry, 10 ft. in depth. The steam cylinder is 1½ in. thick. The piston is 15 in. deep at the centre, and has two outside rings of cast iron, each 4 in. deep and ⅞ in. thick, and one inner ring 8 in. deep and ⅞ in. thick. These rings are set out by 12 semi-elliptic springs, in the same manner as locomotive pistons. The piston rod is 7 in. in diameter. It is not keyed into the cross-head, but is turned cylindrically to 6½ in. in diameter where it goes through, its bearing in the cross-head being 18 in. long. Above this the rod is held by a single nut 7 in. high, screwed upon a square-threaded screw on the rod, and further fastened by a pin. This mode of fastening is dictated by the engineer of the Thomas Iron Company. The cross-head is guided by slides, the wearing faces of which are 4 in. wide on the two sides, and 2½ in. on the edge. The slide brasses or ribs are 16 in. long. The cross-head is connected in the usual manner, by links, to the beam. The support of the beam is a cast-iron hollow tower with open sides. This tower is cast in four sections. It is 11 ft. 6 in. square at the base, and the height to the centre of the plummer block, and including the bed plate, is 33 ft. The sides of the tower are 1½ in. thick, the beads being 2 in. thick. A heavy Egyptian cornice runs around the tower below the plummer block. The whole weight of this tower is about 74,000 lb. The beam is double, or in pairs, each casting being about 33 ft. 11 in. between extreme centres, and 7 ft. deep at the centre. Both beams are cast solid or without open work. They are 1½ in. thick, the flange around the edge being 10 in. wide and 4 in. thick, as is also the centre rib in which the pin for working the air-pump is fixed. The beams are 3 ft. 11 in. from centre to centre. The main centre pin, by the desire of the engineer of the Thomas Iron Company, is of cast instead of wrought iron. It is 10 ft. 2 in. long, each journal being 20 in. in diameter, and 24 in. long. The bearings in the plummer blocks are of hard brass, 2 in thick. The wrought-iron pin, fastened in the prolongation of the steam-end of the beam, for the attachment of the connecting rod, is 12 ft. 6 in. long (the two connecting rods working on the outer sides of the two fly-wheels, being 11 ft. 6 in. apart from centre to centre). This pin is 13 in. in diameter through and between the halves of the beam, the connecting-rod wrists being 9 in. in diameter, and 10 in. long. The connecting rods are of forged iron, 31 ft. long from centre to centre, 9½ in. in diameter at the middle, and 6 in. at the necks. They are trussed in the plane of their motion, as is usual in large connecting rods. It strikes us as singular that engineers have not yet begun to make such large rods flat-sided, as has been long since done in the case of locomotive connecting rods. Such a form is what is needed. It will be borne in mind that, when the engine under notice is in regular work, but little steam can come upon the connecting rods, unless at the extreme ends of the stroke; but in case the strain be shut off, and a few strokes be made by the momentum of the fly-wheel, the whole resistance overcome in the blast cylinder would be represented by the strain transmitted through the connecting rods, which require, therefore, to be as strong as if the whole power of the engine were being constantly transmitted through them. The main shaft, just in front of and nearly at the base of the cylinder, is 20 in. in diameter, and carries a fly-wheel at each end 27 ft. in diameter, and weighing 30 tons each. The hubs of these wheels are 8 ft. 11 in. in diameter, and have a bearing of 22 in. on the shaft. They are 16 in. thick elsewhere. They are bored with radial sockets to receive the inner ends of the ten arms, these ends being turned to fit the sockets, and secured therein by keys—the arrangement generally adopted by Messrs. Morris and Co. The rim of the fly-wheel, 10 in. on the edge and 14 in. on the side faces, is cast in sections, each section being cast whole with one of the arms.

Looking now to the other end of the engine, the blowing cylinder, 108 in. (9 ft.) in diameter, is 1½ in. thick. Its piston is packed with cast-iron rings, which are to be run for a year or two, to get a smooth surface in the cylinder, after which wooden packing will be substituted. The piston rod of the blowing cylinder is 8 in. in diameter, and is connected by links to the end of the beam. The top and bottom heads of the blowing cylinder are gridironed, so that more than seven-eighths of their entire area is either inlet or outlet opening for the air. The valves are of leather, with a thin sheet-iron back, and opened as if hinged at one side, all the valves closing by their own weight. There are 27 large inlet valves in each cylinder head, each divided into a great number of small openings. The blast receiver into which the air is forced is 10 ft. in diameter and 40 ft. high. 630 cubic feet of air (measured at atmospheric pressure) is blown at every stroke, giving, say, 25,000 cubic feet per minute, at the ordinary rate of working. The ordinary pressure of the blast is to be, we believe, 8 lb., although the engine is built for a regular pressure of 10 lb.

The steam valves are of the double-beat, or steam-boat kind, the steam valves being 14 in. and 13 in. in diameter, and the exhaust valves 14 in. and 15 in. The rods for lifting the valves stand exactly over the main shaft, and the lower end of each rod carries a cast-iron roller, 8 in. in diameter and 3 in. wide, upon which a suitably-shaped cam on the main shaft strikes at each revolution. The valve motion, therefore, is the most direct possible, no eccentrics, eccentric rods, hooks, or rockers being employed. The air pump is 3 ft. 6 in. in diameter, the bucket having a stroke of 6 ft. 3 in. The air-pump rod is cased with copper, as a protection against bad water at the works, and is 4½ in. in diameter at the outside. The engine with all its attached parts, but exclusive of boilers, is estimated to weigh upwards of 650,000 lb.

STEAM COAL USED IN THE NAVY.

The consumption of coal in the Navy is now becoming so considerable, by reason of the increasing proportion of steam-vessels, that coal-owners will naturally look in this direction for an extension of their business. This subject having lately been brought under our notice, we believe that a statement of some facts, which we have ascertained with regard to it, will not be without interest to many of our readers.

Supposing the case of a coal-owner, who was working a mine that yielded what he knew to be, or what he had every reasonable grond for believing to be, a good steam coal, how was he to proceed in order to have it brought into use for the Navy? This question arises, first of all, because the use of certain selected coals in the Navy, by sanction of the Admiralty, establishes a kind of prestige, which is, doubtless, not without considerable influence in determining what kinds of coal are used for steam purposes in the vessels of the commercial navigation companies.

The Admiralty has a list of certain kinds of coal which they have recognized as applicable for use in the Navy, in consequence, it may be presumed, of their being considered superior to other kinds of coal for that purpose. But it may easily be supposed that as the working of coal progresses and developes, this list will not comprise all the coals that are, on these grounds, entitled to be regarded as superior steam coals. How, then, can the quality of a new kind of coal be established, so as to become entitled to be placed upon an equality with those recognised by the Admiralty; and how can a recognition of that equality be effected in such a manner as to ensure the coal being placed on the Admiralty list?

We find upon inquiry that the Admiralty adopt a system of trial before placing any coal upon their list as recognized to be suitable for the purposes of steam navigation. It is at the option of the Storekeeper-General of the Admiralty to sanction or refuse such a trial of a coal being made. If the evidence given to him of the quality of a coal is such as to induce him to order its being tested, the trial is made at the Woolwich Dockyard, at the cost of the applicant, and according to the results obtained the coal is or is not placed upon the list.

But so far we have been able to learn, the mere placing of a coal upon the Admiralty list does not by any means ensure, or render more probable, the use of these particular kinds of coal in the Navy. The Admiralty list of coals is kept private, and in practice they adhere to a plan recommended some years ago by the Commission who examined the question as to the coals best suited for use in the Navy, of restricting themselves to Welsh coals exclusively. The only kinds of coal for steam purposes for which tenders are received by the Admiralty are Welsh coals.

There is, however, reason to believe, as we have often shown in the *Journal*, that there are many of the North Country and other coals that are in every respect as well adapted for use as steam coals as the coals of Wales, if not in many respects better. In many cases also a mixture of North Country coal with the Welsh coal is highly advantageous, and has consequently been largely practised in some steamers. There appears, therefore, to be an undue preference shown to the coals of Wales, and the coal-owners of the northern districts have good reason to complain of being precluded from participating in the advantages that are now entirely enjoyed by the Welsh proprietors.

There are also many other kinds of coal worked in Yorkshire, such, for instance, as some of the Silkstone coals, which deserve, at least, to be tried, as regards their applicability for steam purposes, and which would, in all probability, be found worth more notice in this respect than they have yet received.

The very careful experiments made at the instance of the Newcastle Colliery Association, some years ago, fully established the fact that in the [illegible] tion of coals made for the Admiralty the [illegible] and excellence of the coals of that [illegible] fully appreciated, and that the [illegible] conducted in such a manner as not to [illegible] a fair comparison of them with the [illegible] This question is one not only of [illegible] national importance, and on this [illegible] that in referring to it we may [illegible] tribute towards its being more [illegible] in a manner consistent with its [illegible] *ing Journal.*

BILLINGHURST AND REQUA'S PORTABLE BATTERY.

Fig 1.

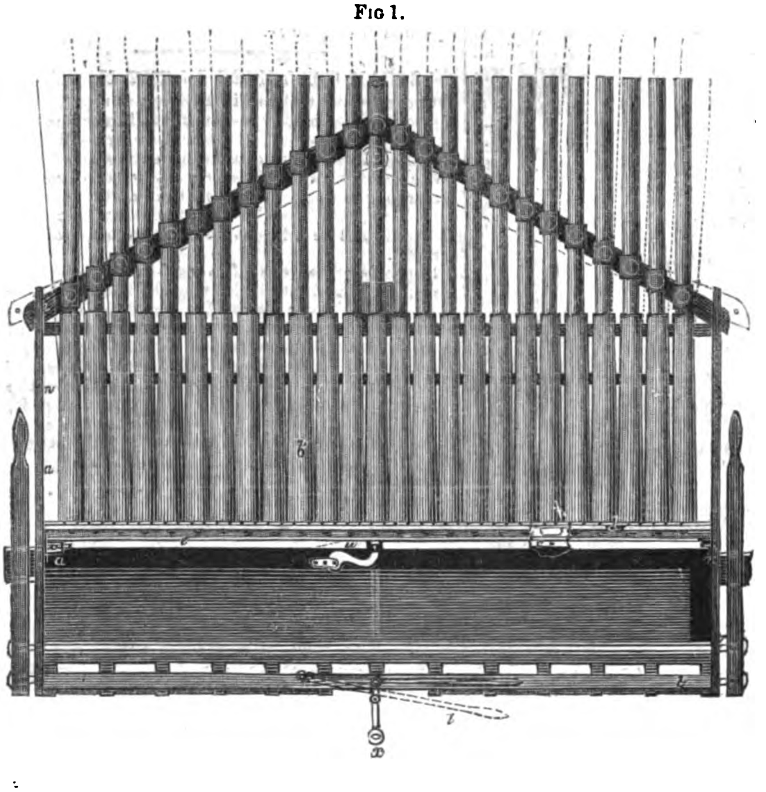


Fig 2.

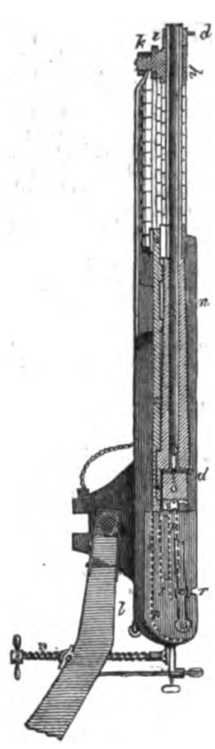


Fig 4.

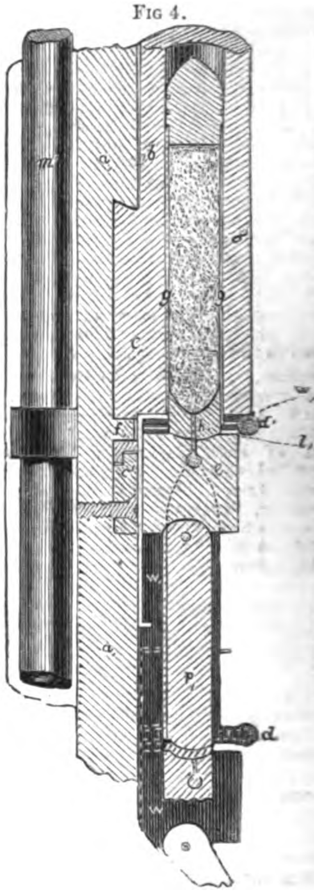


Fig 3.

BILLINGHURST AND REQUA'S PORTABLE BATTERY.

Letters Patent have been granted to Mr. W. Billinghurst and Mr. J. Requa, of Rochester, in the State of New York, for the invention of an improved portable battery.

Fig. 1 of the accompanying drawings is a plan or top view of the invention.

Fig. 2 is a vertical section taken through the parts in the direction of the line *y*.

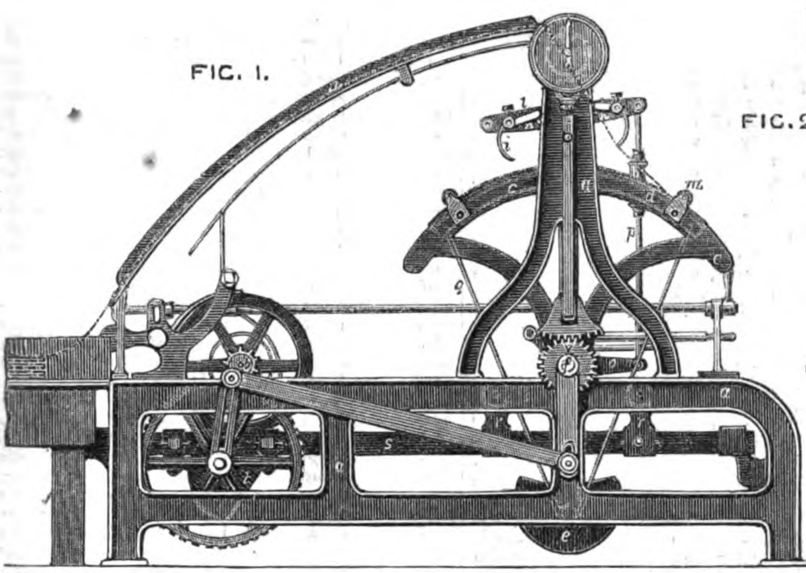
Fig. 3 is a rear elevation of the cartridge holder or clamp, shown open, and containing the cartridges.

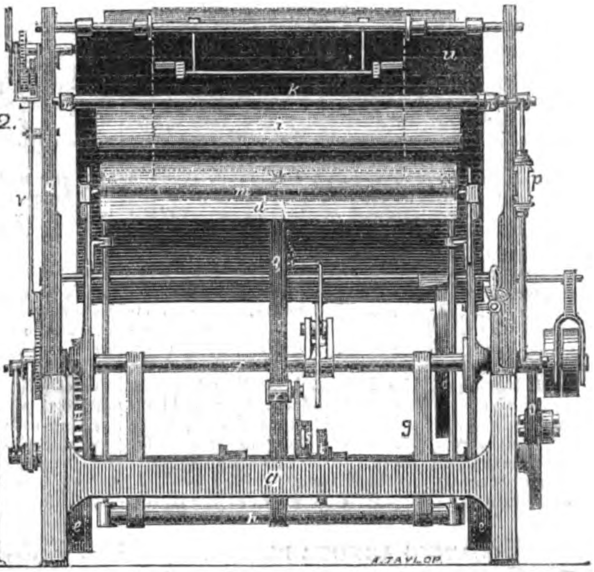
Fig. 4 is a longitudinal central section of the cartridge case, breech bar, and part of the barrel.

Similar letters of reference indicate corresponding parts in all the figures.

The nature of this invention consists in a series of barrels, to be loaded from the breech and fired nearly simultaneously, the barrels being fitted so that they can be diverged more or less at pleasure to regulate the spread of the balls as fired; and the construction and operation of this invention is as follows:—The bed *a* is of iron, and may be of skeleton form. There is a recess made in the upper face of the bed transversely, to receive the pivot shanks or projections *c* of the barrels *b*; this recess is formed on the front side circularly under each barrel, as seen by dotted lines, fig. 1, a portion of one barrel, the clamp *d*, and of the bar *e*, being broken away for that purpose. Each barrel is pivoted to the stock by a screw or bolt *f* passing through the shanks *c*, and the shanks being held down by the plate c^1. The centre barrel of the series is fixed to the bed *a* by a screw or otherwise. A ring *h* is provided on each barrel and fitted to slide, except the two end rings encircling the outer barrels which are fixed thereto. They are all pivoted to the bars *i* (by threaded shanks *j* and nuts *k*), and the said bars are placed diagonally under the barrels, as seen in fig. 1, and are halved together, forming a hinged or toggle joint under the centre barrel, where they are connected to the rod *m*, and by that to the lever *l*. By moving the lever *l* towards the rear of the battery, the barrels are diverged or radiated to cause the balls, when fired, to spread. The breech bar *e* is made solid, and is entirely detached from the barrels and also from the cartridges; there is a hole *s* drilled through it longitudinally, as indicated by the dotted lines in fig. 1, and branches leading therefrom to the side of the bar opposite each barrel, and one from the cone f^1 intersecting the branch opposite. The bar is countersunk at the mouth of each branch to fit the spherical form of the heads h^1 of the cartridge cases, as shown in fig. 4; the ends of the hole or tube *s* are closed by the transverse pin 6. The flame passes from the cone f_1 to the cartridge opposite, and from that back into the tube *s*, and communicating through all the other branches, produces a simultaneous discharge. There is a cap piece *o* at each end of the breech bar *e*, which slide in slots, indicated by the dotted lines, made through the side pieces *n* for that purpose; the breech bar is connected to one of these cap pieces by two dowels (at *r*), and to the other by the sliding bolt a^1, which allows the bar to be removed at any time; and in case of a forced abandonment of the battery it should be taken away, thus rendering the battery entirely useless to its captors. The plate *p* is hinged at each of the front corners to the cap pieces *o* by a pivot or screw *v*, seen in fig. 1, and the rear corners are provided with journals r^1 that reach through the levers s^1. The latter are fixed to the rock shaft *t* which forms their fulcrum. The rear edge of the plate *p* drops in front of the heavy rib *x* on the bed *a*, as seen in fig. 2, and it thereby constitutes a solid backing to the breech bar *e*, to sustain that against the recoil of the explosion. The centre of the journals r^1 drops below that of the rock shaft *t* before the plate *p* rests on the ledge t^1, so that the levers s^1 act as diagonal braces to keep the plate *p* in its proper position during the discharge. The hammer *u* is pivoted to the plate *p* by means of the screw k^1, which passes through the bracket v^1 and through the cam-shaped portion of the hammer into the plate, and as the rear edge of the plate *p* is raised by the movement of the levers s^1, the head p_1 of the hammer is thrown back from the cone by the upper corner of the bar *e* striking the cam face u^1 of the hammer to the right of the line of its axis, the latter being so arranged as to cause the said cam face to just touch the bar when the head p^1 is against the cone f^1, and by this construction and relative arrangement of the hammer with the breech bar the possibility of a premature discharge of the battery is entirely prevented, because the head p_1 cannot touch the cap until the backing plate *p* is down to its place. The hammer is operated by a lanyard in the ordinary way. There is a thin metallic rack or guide *w*, figs. 2 and 3, placed between the sliding or breech bar *e* and the bed *a*; the front and rear edges are turned up, as seen in fig. 4, the front edge being scalloped on the line of each barrel, and the distance between the two edges should be equal to about one-half the length of the cartridge cases added to the width of the bar *e*, and this rack *w* is moved by a lip under the front edge of the plate *p*. By making the guide of such a width, it only traverses about one-half as far as the bar *e*, which leaves the scalloped front edge between the ends of the barrels and the bar when the latter is withdrawn. The cartridge holder or clamp *d* is composed of two wings made of thin sheet metal and hinged together. The openings l_1 through the wings are made to receive the cases *g*, and retain the said cases by the flanges m_1, which are clasped between the wings of the clamp *d* when closed, whereby the cartridges may be moved about, as when being transferred from the caisson to the batteries, &c., without danger of being misplaced or lost. The cartridge cases are composed of a thin metallic cylinder *g*; one end is closed by a solid metallic head h^1, the outside of which is made spherical, to fit against the cavity in the bar *e*, and allows the barrels *b* to be diverged, without impairing the joint between the cartridge head and the bar *e*, which is a very important feature. The head h^1 is encircled by a projecting flange m_1. The cylindrical portion of the head is made to fit snugly into the case *g*, and is bored out about in form of a parabola, thus

MOULD'S IMPROVEMENTS IN FOLDING AND MEASURING FABRICS.





leaving a thin edge against the case *g*, and these heads may be soldered in. The object of making the head so heavy is to give proper strength to that portion of the cartridge case necessarily intervening between the end of the barrels *b* and the breech bar *e*, which space is occupied by the clamp *d* and the scalloped rest or guide *w*. These cases may be loaded with patched bullets, and a wad also, if desired, saturated with grease, which allows any number of discharges without stopping to clear the barrels. A quantity of holders or clamps *d* are supplied with charged cartridges, and placed in suitable caissons for transportation. There is a sight d_1 fixed to the centre barrel, and there may be another attached to the rear of the bed *a* in the centre, as at s^1.

The whole battery is designed to be placed upon a light field carriage, and to be provided with an elevating screw *s* similar to ordnance.

Summary of the operation.—The levers s_1 are thrown back, placing the plate *p* in the position indicated in fig. 4, which also draws back the breech bar *e*, and leaves the scalloped edge of *w* between the rear end of the barrels and the bar *e*. A clamp containing the cartridges is then placed between the breech bar and the barrels, the cartridges resting in and being guided by the said scallops, and the levers s^1 are thrown forward, which forces the cartridges into their respective barrels. Either of these movements, that is, forward and back of the plate *p*, would force the hammer *u* away from the cone, so that the cap may be placed upon it without any further preparatory adjustment of the hammer, and the battery can be fired at will. After the discharge, the levers s^1 are again thrown back, which by the plate *w* withdraws the empty cartridge cases, when they may be removed, and another set supplied as before.

MOULD'S IMPROVEMENTS IN FOLDING AND MEASURING FABRICS.

Letters Patent have been granted to Mr. William Mould, of Belmont, near Bolton, for improvements in apparatus for folding and measuring fabrics.

These improvements consist in having two swinging concave blades or knives placed above a reciprocating table in the form of a segment of a circle, such table being supported in a suitable framework, and allowed to yield or fall, the yielding being obtained by means of a vertical rod, to which the yielding segmental table is attached, such rod sliding through the axis of the segment, and supported by means of a strong elastic material passing around the axis of the segment, and underneath a transverse projection fixed to the lower end of such vertical supporter rod. On each side of the segmental table is a roller covered with india rubber, flannel, or other suitable material, and which may, if required, be actuated and caused to revolve in one direction by means of the cloth being forced beneath it, and retained in such position during each repetition of the folding blades by means of a ratchet wheel upon its end coming in contact with a pawl or catch.

Fig. 1 is a side elevation of the machine, showing the table and its elastic bearing upon which the fabric is folded, and the curved blades for placing the fabric beneath the rollers to retain the fabric in its position. Fig. 2 is a front view of the same.

In fig. 1 *a*, *a*, is the framing of the machine, and *b* the main driving shaft supported therein; *c*, *c*, is the vibrating or oscillating framing, within which the yielding table *d* (in the form of a segment of a circle), and supported separately by the framing c^1 is placed; the framing terminates at its lower extremity in the counterbalance weights *e*, *e*, and is mounted on the central shaft *f*, *f*, upon which it oscillates, the elastic endless band *g* passes round the said shaft, and also round the rod or bar *h* attached to the vertical bars c^1, by this means a constant upward and yielding pressure is imparted to the table to retain the fabric in contact with the rollers *m*, *m*, during its folding. The blades *i*, *i*, are secured to the rods *k*, *k*, and are kept by means of the fingers and studs *l*, in the required position to place the fabric between the table and rollers *m*, *m*, which are covered with india rubber, the said rods *k*, *k*, being attached to the beams *n*, *n*, which are caused to vibrate on a centre in a contrary direction to the table by means of the bell-crank lever *o* and connecting rods *p*, *p*, from the crank on the main driving shaft *b*, the oscillation of the blades being nearly uniform. The strap *g* extends from one end of the yielding table to the other, passing beneath the rod *h*, and is pressed alternately by the bowls or rollers *r*, *r*, so as to depress the ends of the table, and ease the cloth from the pressure of the rollers *m*, *m*, whilst the blade is placing the next fold beneath them, the bowls *r*, *r*, being secured upon the sliding rod *s*, actuated by the cam *t*, and driven by the spur gearing *w*.

In order that the action of the several parts may be readily understood, suppose the machine is just commencing to fold or plait the fabric, the yielding table and framing is caused to oscillate by the crank and connecting rod, or other suitable mechanical arrangement, at the same time and identical with each oscillation, the swinging concave blades are brought into contact with the fabric to be folded, which passes over the guide board *u*, the blades forcing with each oscillation the fabric beneath the rollers, giving at the same time a slight turn to such rollers as are covered with india rubber, or to which a small ratchet wheel is fixed, preventing, by means of a pawl or catch, any backward movement to the rollers, at the same time causing the fabric to be firmly retained between the rollers and yielding segmental table, and forming thereby one complete fold during each oscillation, and so repeating such oscillation until the whole piece is folded, an index for measuring the length of the folded fabric being applied to the machine and worked by the rack and pinion *v*, as shown.

INSTITUTION OF MECHANICAL ENGINEERS.

The four days' proceedings of the Liverpool meeting were brought to a termination on Friday last. Soon after ten o'clock in the morning a special train, provided gratuitously by the London and North-Western Railway Company, left Lime-street Station for Parkside, 17 miles from Liverpool, and about 14½ from Manchester. At this place Mr. Ramsbottom, the talented principal engineer to the company, exhibited in action the water trough for filling tenders in motion. There is a long trough for the up and another for the down line, each a quarter of a mile in length, between the rails, and when a train proceeds at a rate of 22 miles an hour and upwards, the water is forced up a tube into the tender without the necessity of stopping—a great desideratum in the case of goods and other through trains where there is much traffic. From Parkside the members of the Institute went to Crewe to inspect the very extensive locomotive and rail works of the London and North-Western Railway Company. The rail works were the first visited, and here was exhibited the rolling of a number of Bessemer steel rails; in fact, the whole process, from the manufacture of the steel ingot to the completion of the finished rail, all done with extraordinary rapidity. Mr. Bessemer was present, and accompanied the party through the works. A substantial luncheon was served in the large hall of the Mechanics' Institute. Mr. Ramsbottom presided, and fully ensured the comfort of his numerous guests. After the repast, Mr Robertson, a gentleman of eminence in mechani engineering, proposed the health of Mr. Ra bottom, with whom he had worked in life with the hammer and chisel, as had many present been employed, and whom he remem becoming the Superintendent of that little li Manchester and Stockport Railway, the com ment of the Manchester and Birmingham li developed into the Great London and Western system, the extensive works of w visited he superintended with such rare Mr. Ramsbottom responded in a mode and then the party resumed their inspec whole of the works were viewed, in large smithy, the rolling mill, th fitting shops, the axle case-hardenin smithy, the frame-shotting machi scouring and wheel-turning d erecting shop, and the shop

grinding. The most recent improvements in the multifarious machinery in busy operation were explained by Mr. Ramsbottom and Mr. Webb, his principal assistant. The talented Superintendent's patent safety valve was exhibited, and the new travelling cranes, also that gentleman's invention. These latter, of course moved by steam, carried about an engine weighing nearly 30 tons, either transversely or longitudinally, and raised and lowered it as easily as though the ponderous mass were a bunch of grapes. Some smaller steam cranes were also shown, running on a single rail. On the completion of the inspection, those members of the Institute going southwards availed themselves of the ordinary train. Later on, the special train returned to Liverpool, where the rest of the party separated. The party visiting this town expressed their acknowledgments to Colonel Clay, the President, Mr. W. Stubbs, C.E., the Honorary Secretary, and the members of the Local Committee, for the arrangements made, in conjunction with the General Committee, for the congress now terminated. It was admitted on all hands that the Liverpool meeting has been one of the most interesting of the many held annually since the formation of the association, which numbers among its members many men famed for their mechanical genius. The place for the next year's provincial meeting has not yet been fixed. It will, however, take place somewhere in the North.

COATING ARMOUR PLATES.

The arrangement at the north end of the steam factory at Plymouth for the experimental coating of an armour-plate with copper is the greatest known attempt yet made in electro-metallurgy, and that it is being now made is due to the anxiety felt by the Controller of the Navy and the Admiralty to discover a means of preventing the oxidation from which iron-clad ships at present so severely suffer. Mr. Walam, of London, who is carrying out the experiments at Portsmouth, laid before the Controller plans for enamelling iron with brass or copper with the use of a little alkaline solution, the deposited metal to be of any specified thickness, brightness, or hardness. In accepting Mr. Walam's proposition, as an experiment copper was selected as the metal to deposit, and the arrangements are now so far complete that on Thursday week a trial plate, 15 ft. in length, was exhibited to the Lords of the Admiralty covered with a thin deposit of copper to show its nature. In one part of the building, where the apparatus is fixed, lay the armour-plate for coating, uncleaned and rough, just as it came from the drilling machines. It was 15ft. in length, 3ft. 5in. in width, and 4½ in. in thickness. Next to this huge piece of metal was a piece of iron plate suspended in slings. This had just been taken out of the "pickling" tank, and scrubbed with sand, all impurities being gone from the surface of the iron, which was then seen in all the clear lines of its grey fibre. A few feet from this cleansed plate was a plate of similar dimensions, but which had just been removed from the depositing tank, were it had been placed four hours. When removed, it was found to have received a really beautiful and bright hard coating of copper. These three plates thus illustrated the three stages—the uncleansed, the cleansed, and the electro-plated iron. The process of electro-coating by Mr. Walam's process, and the arrangements of his batteries and tanks, are as follows:—In the upper storey of the factory are erected the necessary batteries, in this instance composed of a series of five cells, containing a zinc surface of 720 sq. ft., and of copper of 1,500 sq. ft., the cells being charged with about 1,200 gallons of diluted sulphuric acid. From these batteries conductors—bands of copper 3 in. wide and half an inch thick—lead down to the depositing tank, which is 17 ft. long, 18 in. wide, and 5 ft. in height, and filled with a solution of cyanide of pottassium and tartrate of ammonia. This tank is of iron, and has an outer casing, which enables the solution to be heated by steam. The pickling or cleansing tank is nearly of the same dimensions, and is filled with a weak solution of sulphuric acid. The iron plate is placed in this tank first for a certain time, then taken out and scrubbed with sand, and afterwards placed in the depositing tank, the solution in which completes the cleansing process, and prevents the formation of any oxide between the bare iron and the deposited metal. The solution in the tank being heated next to 150 deg., the batteries are connected, and the copper is not only deposited upon the iron, but is driven into the open pores of the metal, and thus becomes a part of the plate itself, and forms an almost indestructible enamelled coating.—*Times.*

RAILWAY BREAKS.

We (*Liverpool Albion*) have been favoured with the opportunity of inspecting a very nicely constructed working-model of a railway train, consisting of 8 carriages and a locomotive-engine, working on a railway 30 ft. in length, constructed for the purpose of showing the application and efficacy of a newly-invented system of breaks, by which any number of carriages can be stopped almost immediately at whatever rate of speed it may have been running. Like most inventions of importance, this, which has been made by Mr. E. P. Houghton, of Seel-street, in this town, is marked by great simplicity in its arrangements and mode of working. He, in the first instance, insists that every carriage in a train, whatever number there may be, shall be furnished with a break to lock its wheels. The next, and a highly important feature in Mr. Houghton's invention, consists in the fact that all the breaks on all of the carriages shall be connected by connecting-rods, and held together by coupling-chains, similar to the coupling-chains which at present link the different portions of the train together. The connecting-rods are each furnished with a spiral spring in its central portion, by which all jerking or abrupt action is prevented in working the apparatus. Another important feature of this invention is, that the connecting-rods are allowed to move upwards or downwards to a considerable extent in a sort of slotted suspension hooks, so that ample provision is made for connecting carriages which differ in the height or diameter of their wheels; and further, that each individual break throughout the whole length of the train can be brought into immediate operation from either, or from both of the ends. This latter object is provided for by placing a shutting-lever in the guard's van at the fore-part, and another in the luggage-van at the after-part, the working of either of which by stopping the carriage to which it is immediately applied tightens the coupling-chains of the break connecting-rod in front of or behind it, as the case may be, and so applies the break of that carriage to its own wheels, which again in its turn checks the speed of the one next to it so rapidly as to be simultaneous all through the train, all shock or abruptness being effectually guarded against by the equalizing power of the spiral spring working on the central portion of the connecting-rods as already stated, and so on till all the carriages in the train are completely checked. The working of this very complete and efficacious system of break-application, as exhibited in the model, is, in every respect, most complete and satisfactory. The extent and rapidity of the checking-power, which is almost instantaneously obtained, it is difficult to believe without ocular proof; but the operation once witnessed, the conviction of its value and importance becomes fixed and irradicable. The plan recommends itself by its simplicity and the efficacy of its operation; while its value as a means of preventing accidents is at once perceptible to any one in the slightest degree acquainted with the principles which regulate mechanical action. This system of applying breaks to railway trains, which is exceedingly ingenious, has, we understand, been protected by patent, and has met with high approbation from gentlemen of eminence in the engineering world, to whom it has been submitted for inspection.

A NEW PORTABLE GAS FURNACE.

We have lately had an opportunity of witnessing the action of a new portable gas furnace, invented and patented by our townsman, Mr. W. Gore. As this furnace appears to us far to exceed anything that has previously been done in this direction, we cannot doubt that a description of it will prove interesting to our readers, to whom the invention is likely to be of more practical value than to any other community in the kingdom, and probably in the world.

The general features of the furnace are as follow:—It produces a "white heat" by means of ordinary coal gas and atmospheric air, without the help of bellows or tall chimney, and the melted substances are at all times perfectly accessible without chilling them or interfering with the action of the furnace; and if the crucible breaks the melted substances fall, without loss or injury, into a dish beneath. This is an important advantage to workers in gold and silver. The furnace is simple in construction, safe in use, portable, requires no brickwork erections, and may be used in any situation where gas is available. It is set in action simply by lighting and adjusting the gas, exactly as in an ordinary gas-lamp, and requires no further attention. It consists essentially of two open cylinders of fire-clay, one within the other, the outer one being much thicker and a little taller than the other; and a gas burner of very peculiar construction placed at the bottom of the interior cylinder. The crucible is supported inside the interior cylinder, near the top, by three projecting pegs of fire-clay forming part of that cylinder. The outer cylinder is covered by a moveable plate of fire-clay, which has a hole in its centre for the introduction of the crucible and materials, that hole being closed by a clay plug, with a small hole in it for stirring or examining the melted substances. The burner consists of an upright metallic tube, open at both ends, deeply corrugated at its upper end, so as to present the appearance of a star of numerous radiations, and the corrugations diminish gradually to nothing at about half the length of the burner downwards. Gas is admitted into the lower end of the burner by a common gas tap; it there mixes with a large quantity of air, and the mixture rises upwards; the flame commences at the top of the burner, and burns with great intensity within the inside cylinder to the height of the crucible; the heated products of combustion pass over the top edges of that cylinder, then downwards between the two cylinders, and into the chimney through a hole in the side of the outer cylinder near the bottom. The outer cylinder is enclosed within a sheet-iron casing, which has a chimney 6 ft. high attached to it, and is supported upon three iron legs, making the whole apparatus portable, and capable of being used either in a workshop or in the open air, as may be desirable. The various clay portions of the furnace may be used without injury to the action of the furnace until they are completely worn out, and the arrangement is such that they may then be replaced by new ones with perfect facility.

Several sizes of the furnace are manufactured. The first and smallest size consumes 33 cubic feet of gas (value seven farthings) per hour, and is suitable for assayers, jewellers, analytical chemists, experimentalists, dentists, and others. It is capable of fusing eight ounces of copper or six ounces of cast iron; copper begins to melt in it in about twelve minutes from the time of lighting. The second-sized one consumes about twice that quantity of gas, is suitable for manufacturing jewellers generally, and for a great variety of practical persons who require to melt small quantities of gold, silver, copper, german silver, brass, cast iron, glass, and other substances, or require a small crucible heated to high temperatures. It is capable of melting 45 ounces of copper, or 40 ounces of cast-iron, and with its heat up it melts one pound of copper in eight minutes; copper begins to melt in about twenty minutes from the time of lighting. We understand that a still larger size, estimated to fuse upwards of 500 ounces of copper is being constructed.—*Birmingham Post.*

SIMPLE LOCOMOTIVE ENGINES.

While visiting one of our engineering establishments lately, the superintendent pointed to a pile resembling a hay stack, covered with sail-cloth, and with a humorous twinkle of the eye said, "a big thing there." Lifting one end of the cover, he told us to take a look, which we did; but such a combination never before met our gaze. It was a steam-engine on wheels; and was provided with cog-wheels, sectors, bell-crank levers, and mechanical devices innumerable, packed as closely together as the works in a watch. Some men are "Jack of all trades; master of none;" and there are some machines designed to do an indescribable number of things, which are good for no *one* thing. This machine was one of those wonderful contrivances. It was intended to act as a common road engine, steam-plough, saw-mill, and several other things. But it was so complicated in arrangement as to be considered totally worthless for practical purposes; from the frequent leakages and disorder to which it was liable, and the difficulty of managing it properly. Simplicity of mechanism is one of the great aims of thoroughly practical common-sense engineers; and, above all other machines in the world, simplicity is most essential to a locomotive engine, either for rail or road. It is quite different from an engine that has a fixed position in a boat, or in a building; being subject to so many concussions and vicissitudes in moving itself. It should be constructed of as few parts as possible; in order to secure simplicity, lightness, and strength. The locomotives called "dummy engines," have been constructed to obviate a most senseless objection, which has been made to simple, common, high-pressure locomotives. The dummy is a condensing

gine, which in addition to all the parts of a common locomotive is provided with a condenser, ra pump, and other devices, involving extra ight and complex mechanism; simply to make mb the usual noise of the exhaust in the smoke e, while the engine is passing through streets. ery locomotive engineer knows that condensing gines are totally unfit for general railway purses. Depending upon condensing engines, we ver would have had our splendid railway system. e public in town and country should know that common, simple, high-pressure locomotive is er than horses or dummies, and is more easily ntrolled; and that the prejudice against its use on railways is worthy of the ignorance of the dark ages."—*Scientific American.*

TO CORRESPONDENTS.

Received.—W. & Co., T. N., W. B., C. F., E. F., L. & Co.

T. Parker.—The first paragraph of your letter ads strangely. You must alter it before we insert your communication.

T. B. (Stafford).—Neilson's first patent for the t blast was taken out in 1828.

C. F. J. Y.—We would insert your letter with easure did we believe it would aid the cause you lvocate. We believe that you must admit that the ibject has been handled by us with the greatest ipartiality; and were we to insert your letter, we ould be compelled to add a paragraph to justify ir statements, which might perhaps injure your se in a way which we would regret.

THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Would you, in your next publication, kindly iform me when and where the first *tramway* was id down in England. I mean a road with iron ils for the conveyance of heavy goods, drawn by orse, or other power (not steam), and oblige yours uly, Wm. Hall.

[We very much doubt that there is any reliable iformation on this subject in existence. The uestion is a very interesting one, perhaps some of ur correspondents can supply the answer.—D. M. M.]

Miscellanea.

Rotterdam letters mention that a sample of otton from a new source is about to be offered in hat market on Saturday next. It consists of nine ales from the islands of Java, four of which were grown from New Orleans seed and five from East Indian. The quality of the former is stated to be very satisfactory, being not inferior as regards leanness to middling fair North American, while the report is also favourable with regard to staple and strength. The sample grown from the East Indian seed is not equal in the latter respects to that grown from New Orleans.

We learn from New York that the great ocean iron-clads "Dictator" and "Puritan" have at last assumed the shape of complete vessels, and it is hardly exaggeration to say that they surpass any craft ever built there. The hulls are now almost finished, the sides being made with a more formidable armour than those of any other vessels. The turrets will be of immense magnitude, no less than 2 ft. of iron being laid on with the usual wooden backing, in the most improved fashion. These vessels are to be 320 ft. long, 50 ft. wide, and will have 20 ft. depth of hold. Their engines are to have each two upright cylinders of 100 in. diameter, and 4 ft. stroke of piston. Their screws will be 21 ft. 6 in. in diameter, pitch 32 ft. Their boilers are six in number, three on each side, and are of return tubular pattern. They are expected to make 20 miles an hour. Their bows are as sharp, it is said, as a needle.

The "Scotia," belonging to the British and North American Royal Mail Ship Company, on her last voyage to New York, made the most extraordinarily fast run on record. She left Liverpool on the 18th of July, and made the passage to New York in nine days, two hours, and 15 minutes, beating the fastest passage previously made by nine hours and 45 minutes. The two quickest passages previously made were by the "Persia," in nine days, 12 hours, and 10 minutes, from Liverpool to New York; and the "Baltic," in nine days 12 hours.

A new war vessel is in course of construction at Cincinnati. This strange craft is known as "Elliott's War Turtle." It is shaped like a large punch-bowl, with the propeller in the form of a turbine wheel, placed at the bottom, and so arranged as to take water in through eight radial tubes, which may be opened or closed by valves, the said tubes connecting with the propeller and outer edge or hull of the vessel. The propeller passes the water downward from its cylinder, and revolves always in the same direction, and when the vessel is to be moved forward in any direction, one or more of the valves is opened, thereby relieving the pressure on that side, while the pressure still remains on the opposite side to propel the vessel. The turret is very similar in appearance to those on the "Monitors," but is built fixedly and firmly on the top of the vessel, and lined inside with heavy timber. It revolves with the boat by the action of the water upon the rudders placed in the mouth of the radial tubes. It mounts four guns.

A large quantity of land belonging to the Mersey Dock Board, at the north reserve, Birkenhead, will soon be brought into operation for shipbuilding purposes. This is a fortunate circumstance for the Dock Trust, inasmuch as the land has, up to the present time, been producing no income; and for Wallasey and Birkenhead, because it will draw 2,500 or 3,000 additional workmen to the Cheshire side. There is a prospect of the north reserve, Birkenhead, being almost exclusively devoted to shipbuilding yards, and the Dock Board will soon commence operations to reclaim a portion of the land, which is rendered unavailable at present by the water which washes over it.

An agricultural exhibition is to be held at Calcutta in January, 1864, under the direction of the Government, with the assistance and co-operation of the Agricultural and Horticultural Society of India. The object of the exhibition is to bring together for show, competition, and eventual sale, cattle and other live stock, agricultural implements and machinery, and articles of Indian agricultural produce. The machinery will comprise cultivators, ploughs, harrows, thrashing machines, saw mills, oil mills, pumps for irrigation, cotton-cleaning machines, and other implements. The exhibition will be held on the grounds adjoining the Lieutenant-Governor's House, at Belvidere, 35 acres in extent. It will commence on Monday, the 18th January, and will end on Saturday, the 23rd. No charge will be made for the admission of live stock and articles intended for exhibition. All produce and implements for show must arrive in Calcutta and be sent to the exhibition on or before the 31st of December, 1863, and live stock on or before the 14th of January, 1864. All live stock and articles exhibited and intended for sale must have their prices attached to them. A list of the prizes to be awarded may be seen at the offices of the Cotton Supply Association in Manchester, and the names of the parties through whom consignments may be made can also be obtained at the same place.

As a result of the recent meeting at Worcester of the Royal Agricultural Society, a public meeting was held in that city on Saturday last, "for the purpose of discussing the subject of steam cultivation, and, if so determined, to adopt measures for providing steam cultivation, and applying the same to land at an acreage cost." The chair was taken by Mr. E. Holland, M.P. A letter was read from the Right Hon. Sir J. S. Pakington (absent on the Continent), expressing himself favourable to the object of the meeting.—The chairman, in opening the proceedings, entered into the subject of steam cultivation, with which he is practically acquainted, having for some years adopted it on his own estate. He stated that experience of the effects of steam cultivation had proved that, on an average, there was an increase of produce by steam cultivation over the ordinary process to the extent of six or eight bushels an acre; besides which, the corn was superior in quality, and the land was permanently improved in value.—Lord Northwick moved the first resolution, "That as the successful application of steam power to the cultivation of the soil is now placed beyond doubt, and its value is universally admitted, means should be taken to secure its employment in this country."—This was seconded by Mr. H. F. Vernon, M.P., and carried.—Sir E. A. H. Lechmere moved, "That inasmuch as the cost of engines and tackle far exceeds the means of most farmers, it is desirable to establish a joint-stock company (limited), for the purpose of providing such implements by hire or purchase."—Mr. Lukin seconded this resolution, which was also carried unanimously.—Mr. T. G. Curtler then moved a resolution for raising a sum of £3,500, in shares of £1 each, and providing two sets of steam cultivators, with engines.—This also was carried.

A company is being formed in Paris called La Campagnie Generale des Chiffons de Paris. The object of this company appears to be to bring capital to the rescue of the waste substances that are cast idle in all our large cities, for want of patronage and attention requisite to make them useful in our industrial arts. The company propose to organize *les chiffoniers de Paris*, who number upwards of 25,000, and institute a demand for rags, bones, paper, broken glass, and other waste substances. From their extensive sphere of operations, it is contemplated that they will bring to light many tons of material which would otherwise be overlooked and neglected. The projectors of the company are sanguine of very excellent results, from the fruitful field they have before them. They hold out the very tempting prospect of a 25 per cent. dividend to the shareholders.

Some experiments with a new method for coating the iron plates of vessels, to preserve them from oxidation and fouling, have been found so satisfactory that the Admiralty have ordered the whole of the armour plates of the cupola ship "Royal Sovereign" to be thus covered. The material, which has been introduced by Messrs. H. J. Hall and Co., is termed "Brown's vitreous sheathing," and consists of a surface of glass fused upon small plates of iron, sufficiently thin to be to a certain extent flexible, which are applied to the ship by a new adhesive process, and which have been ascertained to be capable of resisting all ordinary contingencies from pressure or abrasion. Compared with other metallic coating substances, this sheating is economical, the cost being 1s. 6d. per square foot. The Peninsular and Oriental Company have tested the invention, and a trial of it has been ordered by the French Emperor at Cherbourg.

"A Practical Gunner," in a communication, says: —The first impression amongst naval and military men as to the manner in which the recent Parliamentary report on Armstrong ordnance is to be fully understood, is fully confirmed by the facts which have recently come to light; for the field-pieces which are therein stated to be a "success" have since had 14 in. cut off from their muzzles, a new coil added in front of the trunnions, new breech-screws and sights fitted, and the charge reduced to below that which is safely fired out of the Prussian field-pieces. With respect to the 40-pounders, a similar change will probably soon be made; for, although they have been gradually increased in weight, they are still too weak to stand the rough wear of actual service. The 110-pounders, when firing even 14 lb. of powder, were very inferior in penetration and damaging effect to the old smooth-bore 68-pounders; but now that the charge has to be reduced to 12 lb., the effect upon even the weakest description of armour would be *nil*. Besides this gun there are the earlier 110-pounders, which are still weaker. I can only fire 10 lb. of powder with the 110-pounder projectiles. Of these valuable weapons there are nearly 100, for which no use has yet been or is likely to be found. These, with the addition of the 20-pounders originally intended to fire 25-lb. projectiles, with a powder-charge of one-eighth their weight—but found too weak to do so—and some 9 and 6-pounders, constitute the whole of the present service Armstrong gun.

A number of interesting and highly important experiments with heavy pieces of ordnance are at present being conducted at the battery of Newhaven, on the coast of Sussex. The object of these experiments is understood to be to test the comparative utility of the smooth-bore and the rifled ordnance in penetrating earthworks, and they form a portion of the series of experiments lately commenced by the Select Ordnance Committee, which have been conducted at different places. The battery at Newhaven contains 8 guns, consisting of a 110 lb. Armstrong breech-loader, a 70 lb. side-wedge Armstrong breech-loader, a 40 lb., 20 lb., and 12 lb. Armstrong breech-loader, and 68 lb. and 32 lb. smooth-bore, and an 8-inch shell smooth-bore. The object fired at is an extensive earth-work which has been erected on the Castle-hill, at a range of 1,060 yards. A telegraphic wire has been laid down from the battery to the earth-work, so that instantaneous communication is maintained between the firing party and those at the butts. The guns are worked by a detachment of about 100 men of the Royal Artillery, from Dover, who are under the command of Captain Tottenham. The members of the Ordnance Committee in attendance are General St. George, R.A., president; Captain Heath, R.N., vice-president; Captain Noble, R.A., secretary; Colonel Gallwey, R.E., Colonel Lefroy, R.A., and Mr. Behenna, R.A. The experiments were commenced on Tuesday, and it is expected that they will extend over ten days or a fortnight.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

39. D. NEVIN and W. COPPIN. *Improvements in machinery for clearing and separating the woody parts from the fibrous portion of flax, hemp, or other like material.* Dated January 5, 1863.

For the purposes of this invention, two sets of revolving flat or curved bars are used, bolted or otherwise secured to arms keyed on to two separate parallel shafts revolving towards each other. The bars of one shaft enter between the bars of the other set, and are kept from contact by means of toothed wheels of equal diameters and equal number of teeth keyed on the two shafts working into each other. One or more of the bars of each set are provided with short teeth, for the purpose of keeping the fibre straight and clear. Above the revolving sets of bars is placed a cover having a rectangular opening through which to pass the fibrous material, and by the action of the bars both sides of the flax or other like material are cleared at the same time. An improved set of holders or clips for holding flax, hemp, or other like material while being dressed or cleaned is provided. Each holder or clip consists of two sets of bars or fluting faced or covered with india rubber or other like material, having a joint or hinge at one end; the two sides closing fit into each other, and are held together by the aid of springs and rack-work, one of these holders being placed or fastened on the end of the material to be dressed; the other end is passed through the opening in the cover of the machine, and dressed between the revolving sets of bars, and when sufficiently acted on is withdrawn, and the dressed end is secured in another clip or holder, the first then being removed by the undressed end, passed through the opening, and dressed in like manner. *Patent completed.*

40. J. A. MUNN and J. D. COBB. *Improvements in automatic walking dolls and other figures.* (A communication.) Dated January 6, 1863.

This invention consists in such a construction and combination of parts that the figures stand upright, and move forward in a manner resembling that of a biped or quadruped in walking. The propelling power of these figures is obtained by the use of a spring acting through gearing upon a horizontal cross shaft, near the bottom of the frame, and supporting the said gearing. *Patent abandoned.*

41. W. E. NEWTON. *Improvements in magneto-electric telegraphs.* (A communication.) Dated January 6, 1863.

The leading object of this invention is to enable the operator by the operation or movement which he makes to designate or select the character or sign which he desires to transmit to develop the electric current by which such character or sign is transmitted. The invention consists in the employment of a magneto-electric engine, by the rotation of which electric impulses are induced alternately in opposite directions. The electro-magnetic engine is connected by suitable conductors with electro-magnets, the polarity of which is alternately reversed by the alternately reversed impulses induced by the engine. An interposed vibrating permanent magnet or armature at the end of a pendulous lever is, by the alternately reversed polarity of the electro-magnets, when these are combined, caused to vibrate, and by means of pallets and arms at the opposite end of the lever, will actuate an escapement wheel, on the axle of which is an index or pointer which is made to traverse round and indicate on a circular series of letters, signs, or figures, the particular sign it is desired to transmit to the distant station. This part of the apparatus is connected with a mechanism which, as the operator indicates or designates the characters or signs which he desires to transmit, will set the magneto-electric engine in action, and will thereby develop or generate the electric impulses which will transmit such character or sign. The second part of the invention consists in combining with the electro-magnetic apparatus, or the equivalent thereof, the escapement arrangement above mentioned, whereby to indicate or develop the character or sign transmitted. *Patent completed.*

42. C. T. JUDKINS. *New alloys.* (A communication.) Dated January 6, 1863.

The object of this invention is the production of alloys which may be variously and advantageously used in the arts, some of which are of use in the place of composition or the alloy commonly used for bearings in machinery, others particularly valuable for gun metal, others from their colour, texture, and lustre peculiarly well adapted for use as substitutes for gold in the manufacture of watch cases, chains, and ornamental jewellery, while others are applicable for various uses, as in springs, sheet metal, wire, sheathing, &c. The invention consists in combining copper and aluminium, or an alloy of these metals, with one or more light coloured metals within the limits of the proportions herein specified, the variations within the said limits being made for the purpose of producing certain desirable qualities in the alloys resulting from the said combination, so as best to adapt them for specific purposes. *Patent completed.*

43. J. ECKERSLEY. *Improvements in the manufacture and spinning of silk, in cutting pile fabrics, and in weaving fibrous materials.* Dated January 6, 1863.

This invention is not described apart from the drawings. *Patent completed.*

44. J. LEIGH. *Improvements in the treatment of gas produced by the distillation of coal, cannel, bituminous shale, boghead, mineral oils, petroleum, or other combustible substances, and for the obtaining certain products therefrom.* Dated January 6, 1863.

This invention consists in the subjection of the gas that is obtained in the distillation of coal, cannel, bituminous shale, boghead, mineral oils, petroleum, or other combustible substances to the action of nitric acid, or of a mixture of nitric and sulphuric acids, by which nitrobenzole and certain other compounds are obtained, and in the course of which certain substances are removed from the gas employed. *Patent completed.*

45. T. VICARS and T. VICARS, jun., and T. ASHMORE. *Improvements in machinery for manufacturing bread, biscuits, and other like articles.* Dated January 6, 1863.

This invention relates to improved machinery or machines to be employed for mixing together materials into a dough or paste to be afterwards made and shaped into loaves, biscuits, and other such like articles. One of such machines consists of a framing carrying two upright shafts on which knives or beaters are fitted or disposed in a helical or spiral direction, the said shafts receiving rotary motion through the agency of bevelled and spur gearing. There is a table or platform connected to the framing, and on the platform there is placed a moveable trough or vessel containing the materials to be mixed together. The platform and trough thereon can be either raised and lowered, or have horizontal rotary motion imparted thereto, either in connection with, or independent of, the vertical rotating shafts and bevelled gearing before mentioned, during the time of mixing the said materials together into a dough or paste to be afterwards shaped as before stated. The other mixing machine above referred to consists of a trough supported by a suitable framing; this trough, which may be either fixed or moveable, is furnished with a shaft revolving horizontally therein; and around this shaft a system of knives or beaters is fixed and disposed in a helical or spiral direction, motion being imparted to the aforesaid shaft and knives or beaters thereon, so as to mix and incorporate the materials placed in the trough into a dough or paste to be afterwards shaped into loaves, biscuits, or other like articles. *Patent abandoned.*

46. J. A. KNIGHT. *Improvements in printing presses.* (A communication.) Dated January 6, 1863.

These improvements chiefly relate to hand presses for printing circulars and other small sheets. The frame of the machine consists of two parallel guide ways in which the bed of the press slides, properly secured together and elevated to any convenient height. At the bottom of this guide way or sides of the frame, about equidistant from the ends, are the bearings of the driving shaft. On this shaft is fixed a gear wheel which works into a ratchet formed on the under side of the bed-plate. By turning the shaft in opposite directions, the desired movements of the bed supporting the form is obtained. Above the shaft an ordinary compression roller is placed. The tympan of the machine is made self-acting by means of a dog or curved piece fixed on the end of said tympan, and acting against a fixed cam on the end of the frame to bring it down upon the form before it comes to the roller, and by a spring to throw it open as soon as it is clear of the roller on either side. When the tympan is brought back, the roller depresses it to make the impression on the sheet. The type is inked and sheet laid on and delivered on each side the roller. The machine may be made self-inking by means of a roller carried by a bent bar, and operated in any convenient manner, but in practice it is found more economical to apply the ink to the press with a hand roller. *Patent abandoned.*

47. M. HODGART. *Improvements in presses for pressing cotton and other substances.* (A communication.) Dated January 6, 1863.

This invention is not described apart from the drawings. *Patent completed.*

48. E. V. GARDNER. *Improvements in the treatment of petroleum and mineral oils, and in apparatus employed therein.* Dated January 6, 1863.

The first part of this invention relates to arrangements of certain apparatus, and to the use of both high and low pressure and superheated steam in connection therewith, by which means the patentee completely obviates all risk of fire and explosion, and contrives to separate the various distinct compounds which are contained in ordinary mineral oils in one continuous operation. The second part of the invention consists of an improved agitator to be used in the purification of these oils. The third part of the invention consists of an apparatus or still used in the rectification of the oils; the fourth part, to certain chemical processes, by means of which he is able greatly to increase the oil and diminish the tarry or heavy carbonaceous products, and to render the various oils free from their unpleasant odour. *Patent completed.*

49. J. G. DAHLKE. *Improvements in machinery for cutting clay in the manufacture of bricks, tiles, and similar articles.* (A communication.) Dated January 6, 1863.

This invention consists in mounting upon a frame with wheels for travelling on rails or trams a set of rollers covered by an endless belt, which belt receives the clay from another set of rollers, on to which it is expressed from a moulding machine. At the further end of the rollers other rollers are fixed, and over them a frame capable of transverse motion; between the endless belt and transverse frame a cutting wire or blade is placed, and the far end of the transverse frame is provided with a door, which usually remains closed, but which may be opened when required. The endless belt rollers and the transverse frame are all connected to the wheeled frame, and are capable of being moved to and fro. On the clay being fed from the moulding machine it travels along the endless belt, and its outer end abuts against the door before mentioned. The cutter is then brought into action and severs the clay between the endless belt and that contained in the transverse frame. Then the transverse frame is pulled out laterally, whereby the clay is brought into contact with, say three, cutting wires or blades, and the three portions of clay so cut, say bricks, are removed ready for being stacked. In being pulled out, the frame falls, and the clay, still continuing to issue from the moulding machine, is received on the rollers over which the transverse frame has been drawn. On the frame being returned to its original position, it rises over the rollers, receives the fresh charge, which is severed as before, when the frame is again pulled out, and so on. It will be understood that the block of clay drawn out by the transverse frame may be divided into any desired number of parts, according to the number of cutting wires to which it is exposed in its lateral travel. *Patent completed.*

50. G. TURNER. *Making leather from waste pieces of leather.* Dated January 6, 1863.

In carrying out this invention, leather cuttings or parings, or other waste pieces of leather or skin, are first converted into pulp by any of the processes already known. This pulp—which may then be washed or left unwashed—is thereupon digested in warm water in suitable vessels. When it is sufficiently digested, the pulp is treated with a caustic alkaline solution, such as is formed by the oxides of alkaline metals, the alkaline earths, the hydrates of such oxides, the subcarbonates of these, or other substances having an alkaline reaction. If desired, animal or vegetable gelatinous matter may be added to, and digested with, the pulp. After the pulp, with or without the addition of animal or vegetable gelatinous matter, has been treated with the caustic alkaline solution, it is pressed or rolled into sheets or bands of the desirable thickness. These sheets or bands are then immersed in tan liquor, or other acid astringent solution, which arrests the action of the alkali, combines with the organic matter dissolved by the alkali, and converts the gelatinous matter into tannate of gelatine. *Patent completed.*

51. J. WHITWORTH and W. W. HULSE. *Improvements in ordnance.* Dated January 6, 1863.

This invention consists in the employment of an improved method of manufacturing ordnance made of what is now termed homogeneous metal, or mild steel or steel iron, or other similar material. The patentees cast an ingot with a hole through it, and afterwards hammer it between an angular-shaped anvil block and a hammer head of a similar or a flat shape. A mandril of a taper form is inserted through the hole cast in the ingot, and the operation of hammering or forging proceeds till the mandril becomes too hot from its contact with the heated metal of the ingot; it is then withdrawn, and a cold mandril is inserted in the place of the heated one, and the hammering or forging is continued until it is made of the desired size and shape. If preferred, a hollow mandril may be used and cooled alternately. The hammered tubular ingot is subsequently annealed. If necessary, the interior surface of the tubular ingot may be converted to the required depth. For heavy guns for ships and fortifications, constructed on what is termed the built-up system, they make the inner tube from a tubular ingot, and strengthen the inner tube with cylinders made of homogeneous metal, as above described, and put on by hydraulic pressure or other suitable means in one or more series as required. For closing the breech of these built-up guns they employ a breech on which screws of two or more different diameters are cut. The screw with the smallest diameter takes into an interior screw in the breech end of the inner tube, and the screws of the larger diameters take at the same time into interior screws made in the second, or second and other series of hoops. *Patent completed.*

52. J. H. JOHNSON. *Improvements in rocket torpedoes, and in the apparatus for directing the flight of the same under water.* (A communication.) Dated January 6, 1863.

This invention relates to a peculiar construction and arrangement of rocket torpedoes, and to improvements in the apparatus employed in directing their flight under water. According to this invention, it is proposed to apply hinged guiding or steering wings to the rear end of the torpedo, which will open out or expand by the action of the gases issuing from the rear end of the torpedo, and so be brought to act upon the resisting body of water, in place of being fixed and situate in the line of the issuing gases, where the resistance required for effecting the steerage is nil, by reason of the gases displacing the water at that part. Springs may be substituted for hinges in attaching the wings if preferred. The rear part of the torpedo—the case of which is of metal—is filled with rocket composition, whilst the front chamber is charged with gunpowder, or other explosive material. This charge is exploded either by the burning out of the rocket composition, or by means of

ny convenient percussion fuse arrangement, which will nsure the firing of the explosive charge the instant the orpedo strikes a resisting object. The means employed for irecting the flight of these or other rocket torpedoes conist of a tube passing through the side of a vessel or fort, nd dipping down into the water some distance below the urface. This tube is passed through a ball and socket, or ther form of universal joint, contained in the side of the essel or fort, and is provided with suitable blocks and ackle for drawing it in or out of the joint, or for adjusting ts angle either vertically or horizontally. *Patent abandoned.*

53. J. Neale. *Improvements in the manufacture of capsules.* (A communication.) Dated January 7, 1863.

This invention consists in combining with a disc made of wood, glass, porcelain, or other suitable material, which may be embossed or otherwise ornamented, a piece of flexible metal, similar to that ordinarily employed in making metallic capsules, which metal—instead of being cut into discs and worked up into a shape resembling a thimble—is first cut out by discs or other suitable means into, or shaped somewhat resembling, a lady's collar, and is then, at a point near the narrowest part of such piece, wrapped round the disc, and by the use of a cord or other pressure, the flexible metal is forced into a groove or indentation formed on the edge of the embossed or ornamented disc. These capsules may be affixed or fastened to the bottles or jars by the ordinary means used for applying metallic capsules. *Patent abandoned.*

54. T. F. Cashin. *Improvements in covering wire, crinoline steel, or hoops for skirts.* Dated January 7, 1863.

It is proposed, according to this invention, in covering wire, crinoline steel, or other article intended for the purpose of stiffening skirts, to apply paper or cloth paper, that is, cloth faced with paper pulp, of sufficient width to cover both the sides and edges and overlap; paste or other adhesive preparation is used to fasten the paper on the steel or other materials, around which it may be simply lapped and folded, or wound around by machinery, or may be drawn upon it between dies and pulleys. Steel wire or metallic bands when necessary are covered with lacker composed with naphtha and gum, or other suitable composition, to prevent corrosion. When covered, the bands or strips of whatever length are subjected to a process of drying by the application of heated irons or rolls, and may be glazed and have a pattern printed thereon; or they may be embossed with sunk or raised patterns, or impressed with appropriate devices and edgings; coloured paper or cloth paper, plain or ornamental, may also be used, or colour may be applied when the article is covered. *Patent abandoned.*

55. W. Cartree and J. Crowther. *An improved mode of perching and dressing textile fabrics during the process of weaving.* Dated January 7, 1863.

This invention is carried out as follows:—Immediately under the breast beam of the loom the inventors place a roller which extends across the loom. The surface of this roller is covered with card cloth, teazles, or other material usually employed for the purpose of raising and cleansing the surface or face of textile fabrics. The pivots of this roller work in adjustable bearings, so that the surface of the roller can be brought into contact (with more or less pressure) with the face side of the fabric which is being woven in the loom. The roller when at work turns round on its axis (with more or less velocity as may be required) by means of a band or strap, or toothed gearing, which communicates motion to it from one or other of the other motions of the loom. By this means the card cloth or other material perches and dresses the textile fabric at the same time that it is being woven or produced in the loom. *Patent abandoned.*

56. W. S. Bruce. *Improvements in lucifer matches, fusees, and other similar lights, and in the boxes or holders for containing the same.* (A communication.) Dated January 7, 1863.

These matches are so prepared that, when lighted, they burn with a flame at one end, and with sparks only at the other, being thus adapted for the various uses of the common match, and at the same time also adapted to the purpose of a cigar or pipe light. The match may be prepared to light at either or both ends. The improved boxes or holders may be made in various ways, and of different materials, chiefly, however, of reeds, or other hollow ligneous substances, veneer wood, natural cork, or any other suitable material, tinted, painted, varnished, stamped, or otherwise ornamented, according to fancy, with different colours and designs, and may also be covered with coloured or other paper, so as to present when finished a neat and compact appearance. *Patent abandoned.*

57. T. Storey. *Improvements in compound waterproof and ornamental fabrics, applicable to various purposes.* Dated Janury 7, 1863.

This invention consists in the manufacture of compound waterproof and ornamental fabrics, applicable for covering and various other purposes, by taking a woven fabric of cotton or other suitable fibrous material, and coating it with one or more coats of oil, oxidized oil, india rubber, or other similar substances or compositions possessing adhesive and water-repellent properties, and then covering the adhesive surface with flock material dyed of any required colour; and, lastly, consolidating or embossing the surface of the flock material with any suitable design. *Patent abandoned.*

58. W. Clark. *Improved media for advertising.* (A communication.) Dated January 7, 1863.

For the purposes of this invention, the inventor makes use of plates, dishes, glasses, and other similar table requisites of dining or coffee rooms, and all public establishments in general, for the supply of drinks and eatables. For example, he engraves, imprints, paints, or otherwise applies in any suitable manner on the plates, dishes, glasses, cups, saucers, and other objects, either plain or illustrated advertisements. *Patent abandoned.*

59. G. C. Grimes. *Improvements in means or apparatus for treating splints used in the manufacture of matches and other lights.* Dated January 7, 1863.

These improvements relate—1, to what is commonly called the clamp filling machine, and they consist in drawing the splints into the clamps from the boxes or holders in which they are placed to be tranferred to such clamps, in place of pushing the splints from such boxes or holders into the clamps, and in using sharp points to stick into the ends of the splints for drawing the splints into position in the clamp. The clamps are placed between the boxes or holders and the drawing means. 2, in place of the clamp boards of the clamping frame being separate and independent of each other, as is the common practice, the patentee connects them to bands or other suitable means adapted to admit of their being suspended at intervals apart from each other sufficient for the free passage of splints between any pair of them, and yet when splints are placed between them of their being pressed together to hold such splints tightly between them. *Patent completed.*

60. G. A. Huddart. *Improvements in buttons.* Dated January 7, 1863.

This invention is not described apart from the drawings. *Patent completed.*

61. J. Aveling. *Improvements in the construction of traction engines.* Dated January 7, 1863.

This invention is not described apart from the drawings. *Patent completed.*

62. G. Dowler. *Improvements in the manufacture of match boxes.* Dated January 7, 1863.

This invention consists in making match boxes with a double bottom or case to contain a supply of strikers or sheets of material, upon which the matches are ignited; this double bottom or case may be formed as a cap to fit on the bottom of the match box. The invention also consists in forming a frame on the bottom of a match box, which will allow the striker to be slipped in and out, so that, when one side of the striker is worn out, it may be reversed; this frame may be constructed to hold more than one striker. It will be best formed by bending up the lower edges of the sides and ends of the box to form grooves, into which grooves a thin metal frame is fitted, which will hold the striker and allow nearly all its surface to be exposed for use. For other forms of boxes this part will be best formed by making a flanged ring or cap to fit the bottom of the box, and which may fit over the false bottom already named. *Patent completed.*

63. G. T. Bousfield. *Improvements in skate fasteners.* (A communication.) Dated January 7, 1863.

This invention is not described apart from the drawings. *Patent completed.*

64. H. Harben. *Improvements in the manufacture of fibrous material for cleansing machinery and other purposes.* Dated January 7, 1863.

In carrying out this invention, the inventor uses zostera marina, or other aquatic weed, plant, or grass, either in a green or dried state, and either whole or in pieces. He steeps the plant in a solution of carbonate of soda, or chloride of lime, or any other alkali with water; when sufficiently steeped he passes it through rollers, or otherwise subjects it to pressure, subsequently to which he partially dries it by exposure to the air or artificial heat. When a sufficiency of the moisture is thus removed, he places it in a machine similar in principle to an ordinary butter churn, in which the plant is revolved, agitated, and beaten till it is sufficiently softened and separated longitudinally; the product is then fit for the purposes to which waste is applicable, and from its fibrous and absorbent qualities it is specially applicable to cleansing of machinery; for this purpose the whole of the plant is made available, and it is not necessary to extract the fibre only. *Patent abandoned.*

65. J. H. Johnson. *Improvements in the permanent way of railways.* (A communication.) Dated January 7, 1863.

This invention relates to certain improved constructions of sleepers employed in the permanent way of railways, and consists, according to the modification of the invention, in using lighter sleepers, whereby a considerable saving of timber is effected, whilst the proper stability of the way is retained by attaching on the upper surface at those parts where the rails rest, or the chairs are secured, and which are most liable to decay, extra blocks of oak or other durable wood of a sufficient length only to give a firm support to the rails. According to another modification, it is proposed to employ short blocks of timber of the ordinary section of sleepers for supporting the rails, or rails and chairs, and to connect these blocks by bars of iron, which bars form the intermediate portion of the sleeper between the rail-bearing surfaces. *Patent completed.*

66. R. Grogan. *New and improved propellers for vessels driven by steam or other power.* Dated January 8, 1863.

This invention consists of certain vanes or blades of a flat, spiral, or other suitable form, two or more of which are mounted upon or attached to shafts, cranks, or beams having either vertical or horizontal axes, and wholly or partially submerged at or in or partially within the sides, bottom, or stern of vessels, where the same (when fitted to the required mechanism of ordinary construction) can be made to act as paddles, or take the place of a screw propeller. *Patent abandoned.*

67. L. Hull. *Having reference to the treatment of ground caoutchouc, and for the purpose of rendering it elastic or improving its elasticity, as well as imparting to such caoutchouc other useful properties.* Dated January 8, 1863.

This invention consists in treating the ground caoutchouc with carbon, spirits, and chloride of sulphur. *Patent completed.*

68. A. Guild. *Improved machinery for breaking and cleaning flax, hemp, and other fibre-yielding plants.* (A communication.) Dated January 8, 1863.

This invention relates to a novel arrangement of drawing gear for operating the nipping rollers of machines intended to be employed in the breaking and cleaning of flax, hemp, and other fibre-yielding plants. In the class of machine to which the invention applies, the woody portions of the material under treatment are broken by passing under the crushing action of fixed fluted rollers, and the broken fragments are loosened from the fibres by a rubbing action obtained by driving the rollers alternately in opposite directions, but in such manner as to produce a progressive motion of the fabrics through the machine. The invention cannot be described without reference to the drawings. *Patent completed.*

69. C. Allen. *Improvements in apparatus for signalling on railways by detonating or explosive signals.* Dated January 8, 1863.

This invention has for its object the providing an improved, efficient, and simple apparatus for signalling by detonating or explosive signals, so that the same may be placed on or taken off the rail by acting on a suitable handle, or otherwise, placed at any convenient distance from the point at which it may be considered desirable to apply the said signals. *Patent completed.*

70. R. T. and R. Monteith. *Improvements in the manufacture of dyes from aniline and its analogues.* (A communication.) Dated January 8, 1863.

The patentees claim the production of red and violet colouring matters by the decomposition of hydrochlorate or sulphate of aniline, or its analogues, by heat, whether those substances are used by themselves or mixed with aniline or its analogues, and whether either of the above mixtures is heated alone, or after it has been mixed with sand or any other finely divided substance as aforesaid. Also the use of salts of ammonia for the purpose described. Also the admixture with the colouring substances (as described) of sand, gelatinous silicic acid, fluoride of calcium, or any other finely divided substances not liable to act otherwise than mechanically upon the substances employed in the process above described. And also the production of brown colours by the decomposition of salts of aniline, or its analogues, by heat, as above described. Whenever hydrochlorate of aniline or aniline is mentioned, the hydrochlorate of aniline of commerce or aniline of commerce is intended. *Patent completed.*

71. J. Punshon. *A balance cylinder with counter-pressure and valves connected therewith for stationary and locomotive steam engines, to prevent overwinding at collieries, to provide extra breakage power to locomotive steam engines, and whenever steam is the motive power to provide counter-pressure to stop instantly the action.* Dated January 9, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

72. C. Worssam. *An improved lithographic press.* Dated January 9, 1863.

This invention is not described apart from the drawings. *Patent completed.*

73. W. H. Tucker. *Improvements in locks and in the modes of connecting the knobs and spindles of the same.* Dated January 9, 1863.

This invention consists—1, in a mode of preventing the positions of the gatings in the levers or tumblers of locks being felt or ascertained by the aid of end pressure directed against the bolts of the said locks, and the patentee produces this effect by the use of a moveable lifting piece, so constructed and disposed in the lock that, if end pressure be directed against the bolt, the said piece will be so influenced by it that a pin or stump in it will lift or gather up the levers or tumblers in a mass, and thereby prevent their being acted on separately by picking instruments, so as to feel or ascertain the position of their gatings. 2, in modes of constructing and connecting the knobs, roses, and spindles of locks in such a manner that their requisite firmness of hold to the doors to which they are attached, and their ready and accurate adjustment to their varying thicknesses, shall be more effectively combined than has heretofore been the case. *Patent completed.*

74. R. Thomas. *Improvements in apparatus for rendering hair wavy.* Dated January 9, 1863.

This invention consists in constructing an apparatus so arranged that the hair to be acted upon is nipped or firmly held between two smooth corrugated or undulated surfaces of peculiar formation, the projections of one of which surfaces fit into the recesses of the other, and on being applied to the hair in a heated state impart to it their corrugated or undulated form. *Patent abandoned.*

75. C. E. Gray. *Improvements in wringing machines.* Dated January 9, 1863.

One form of construction consists of two galvanized iron brackets screwed to a piece of wood. The upper end of each of the said brackets has a vertical slot or opening formed through the same to receive the end of a short bent lever, the lever fitting loosely in a vertical groove in the bracket. The lower end of the bent lever may work either on a fixed fulcrum of the ordinary kind, or on a loose rolling fulcrum, which latter the patentee claims as new in the construction of wringing machines; or the top of the bent lever may work on a loose rolling fulcrum formed by the slot at top of the brackets aforesaid, and be provided with an elastic cushion for the end of the bent lever aforesaid to press against; or the elastic cushion may be adapted to the bracket in such a manner that the lower end of the bent lever may press against the same, and when this arrangement is used the top of the bent lever is not rigidly fixed to the slot in the top of the bracket. The two brackets and levers thus arranged respectively support the ends of the axes of spindles of two cylindrical rollers covered, by preference, with india rubber, the lower roller being supported by the brackets, and the upper roller by the bent levers aforesaid, a winch handle being fixed on the spindle of the lower roller for imparting rotary motion thereto, as usually practised. The upper roller moves outwards as the articles to be wrung or squeezed pass between the rollers, the elastic cushions causing sufficient pressure to express the liquid from the articles as they are passed between the said rollers. The above machine may be fixed to a tub or washing machine by any convenient means. *Patent completed.*

76. E. A. Goupil. *An improved locomotive apparatus called a "spherical wheel."* Dated January 9, 1863.

The object of this invention is the application of the sphere for moving furniture, to vehicles used to transport

cumbrous material, and to locomotion generally. One of the applications of the invention is as follows:—The inventor encloses a spherical ball of any dimension or material in a cavity or socket, the form of which will vary for ornament or solidity from a spherical to a spheroidal, or even a cylindrical shape, subject, however, to the invariable rule that the height of the socket shall be greater than the extent of the radius of the complete sphere, and that the orifice of the said socket be smaller than the diameter of the sphere, but sufficient to permit a segment of the inserted sphere (say about one-third) to project beyond the socket. It will be understood that the socket must bear vertically upon the summit of the sphere, so that the transmission of movement be rectilineal. The sphere being naturally moveable in every direction, one articulation or joint suffices, whereas, with the cylinder usually employed, two articulations are necessary, one vertical and one horizontal. The socket may be fitted to furniture in the same way as the castor it is intended to replace, and to other objects as may be found most convenient. *Patent abandoned.*

77. M. Cartwright. *Improvements in alarums for portable and stationary uses.* Dated January 9, 1863.

This alarum, according to the scale on which it is made, is intended to be worn in the pocket or to be fixed in any part of a building or otherwise. The inventor encloses the alarum in a case, or not, as required. It consists of a spring made to act through wheelwork upon a ratchet wheel, which drives a double ratchet, on the shaft of which one or more hammers is or are mounted, all held between plates or in a suitable frame. There are as many bells as hammers, and on the spring being wound up the hammers are made to oscillate and strike the bells, no matter in what position the alarum is held. He provides a stop pin, which gears into the ratchet wheel and stops the working of the apparatus after the spring is wound up, until it is released from the wheel, and this is done by simply pulling it. *Patent abandoned.*

78. D. B. Parsons. *Improvements in reaping and mowing machines.* (A communication.) Dated January 9, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

79. E. T. Hughes. *Improvements in machinerg or apparatus for printing or staining woven fabrics, warps, paper, and other articles.* (A communication.) Dated January 9, 1863.

This invention consists of a suitable frame of iron or other metal, the sides of which are connected by tie rods and bolts to keep it firm and prevent the sides giving way with the pressure or operation. Between the right and left side of the frame there is a tie piece, and on the left side a trundle shaft or cylinder, with pins to scratch the desired pattern or design, and also projecting pieces to keep the material to its full width. For some patterns the cylinder turns its full circumference, and for others only one-half, the pins being regulated by a lever which slides up and down, and has attached to it a handle. A table, on which the material to be operated on rests, slides in grooves, and is moved on rollers with conical keys, or blocks and screws, by which are regulated the pads or cushions attached to the cylinders for the purpose of giving the requisite pressure on the material which receives the pattern or design. The said table is covered with woollen cloth, or other suitable material, over which is an oil or waxed cloth, the two cloths being kept in their proper place by a comb on the right-hand side of the table, and on the left-hand side a wooden roller, which is also provided with a comb and ratchet to keep the cloth at full stretch. The table is also recessed at its sides, in order to receive the edges of the cloths, and thus regulate the tension of them as required. On the sides of the table are six small rollers, three on each side, to receive the frame when the impression is being taken, shafts or spindles being attached to the frame at each end, which are also provided with rollers with a base to maintain the frame in its proper place, and stop pieces to arrest its motion when necessary. The said frame has conical bearings to receive the moveable table on which the material to be printed or stained is spread, and is prevented moving in the direction of its breadth by the rollers, the frame which holds the rollers being immoveable. On the frame is also fixed a fabric to serve as a lining and prevent stains on the materials being printed. On an indicator is placed a plate, which is turned by a shaft and handle above the framing, and also two pulleys which turn one to the right and the other to the left, by means of bands or gearing, for the purpose of moving the carriage backwards and forwards, which carries the feeder to supply the necessary colouring matter to give the design or pattern required. *Patent completed.*

80. D. Collinge. *Improvements in machinery or apparatus for cleaning and preparing cotton or other fibrous materials to be spun.* Dated January 9, 1863.

This invention consists in adapting the ordinary fan to the purpose of cleaning and steaming the fibrous material preparatory to spinning. The inventor feeds the cotton or other material to the fan by means of an endless band made of laths or other suitable material, and he fixes a grid inside the fan to allow the dirt or refuse to fall through it. At the exit side of the fan he fixes a wire tube, through which the fibrous material passes into a steam chamber, being further cleaned as it passes through the said wire tube. He causes a supply of steam to the said chamber by the means of pipes, so that, as the fibrous material enters the chamber from the wire tube, the steam from any convenient number of pipes penetrates and saturates it. *Patent abandoned.*

81. W. H. Moreland and J. Chappell. *Improvements in winding, warping, beaming, or dressing machines.* Dated January 9, 1863.

The object of this invention is to secure a uniform tension of the yarn on the beam to which it is being transferred from spools or bobbins. The invention consists in the application to the ordinary winding, warping, beaming, or dressing machines that wind from the spools or bobbins, of a drag roller or rollers for taking up the slack yarn caused by the over-running of the spools or bobbins from which the yarn is being wound. *Patent completed.*

82. G. B. Price. *Improvements in sights for firearms.* Dated January 9, 1863.

This invention relates to certain improvements in the sights for firearms, whereby the person using the weapon can at once see whether the sights are perfectly vertical on bringing the weapon to the position for firing. According to this invention, it is proposed to attach a small spirit or liquid level to the side of the flap of the elevation sight, such level being placed transversely to the bore of the barrel. The said slide is like the one ordinarily used, but with the addition of two lugs or projections, one on either side, for the reception of a small glass level, which level may readily be replaced in case of accident, as the one lug or projection is left open for that purpose, and then stopped by clay, wax, or any other convenient substance. It is proposed to attach a guard, so that the level may not be broken when not in use, which guard may be made in a variety of ways, either by having a stationary piece of metal fixed to the flap below the slide, or by fitting a piece of metal to slide over the level, or by having a piece of metal to fall down over it, or in any other convenient way. *Patent abandoned.*

83. W. Tasker, jun. *Improvements in the construction of harrows.* Dated January 9, 1863.

This invention relates to a peculiar construction and arrangement of the frame of harrows. According to this arrangement, it is proposed to employ separate truss bars between the several longitudinal beams of the harrow frame, and to connect such truss bars to the beams in such positions as will afford the greatest strength, by preference at right angles to the beams, which when made zig-zag gives a different trussing; any other angle, however, may be adopted. The truss bars are formed with a shoulder or collar near each end, and are either bolted to the beams or keyed thereto, the ends of the truss bars passing through the beams. Or these bars may be formed with a foot at one or both ends, and secured in the one case by passing the end of one bar through the beam and foot of the next bar, and screwing by means of a nut, key, or riveting; or in the other case by a separate bolt, pin, or rivet passing through both the feet of the contiguous ends of the bars, and through the beam. *Patent completed.*

84. M. Henry. *Improvements in furnaces.* (A communication.) Dated June 9, 1863.

This invention relates to certain regenerator and current reversing furnaces or heating apparatus, patented by Mr. Siemens, in which four regenerators are employed, two of which receive the waste heat of the products of combustion on their way to the chimney, while the third imparts heat to the combustible gases proceeding from their generator, and the fourth imparts heat to the air, the said combustible gases and air combining and evolving a high temperature, valves being employed to reverse the direction of the aeriform or gaseous currents, so that the two regenerators which before received heat from the products of combustion will receive and heat the entering air and combustible gases, while the two others will, in their turn, receive heat from the departing products of combustion. The inventor wishes it to be understood that this immediately foregoing method or arrangement for heating is not of his invention, and he lays no claim to the same considered separately and apart from the application and combination thereof as hereafter set forth and expressly claimed. Now, the present invention has for its object a mode of adapting the said method of heating to the purpose of performing various chemical, metallurgical, and other manufacturing processes, in which are two consecutive operations or stages requiring different temperatures. And the invention consists in applying or combining the before described regenerator and current reversing arrangement with two combined furnaces, hearths, ovens, kilns, or heated or working chambers, in such a manner that by the reversing of the currents each such furnace, hearth, oven, kiln, or chamber shall be alternately brought to the proper temperature for each such operation or stage, and so that the two stages or operations may be performed in each furnace, hearth, oven, or working chamber alternately, and both stages or operations may thus be carried on at the same time in the same apparatus, though in each of its said furnaces, hearths, or chambers in turn. *Patent completed.*

85. W. Grove. *An improved apparatus applicable to the sawing and cutting of wood or other light substances.* Dated January 10, 1863.

This invention consists of a rectangular framework or standard framing of suitable material, upon which an endless band saw, in connection with a fly-wheel, crank shaft, and strap wheels are employed, the said crank shaft or fly-wheel being driven or set in motion through the medium of winch handles or treadles, and the operation of cutting performed by passing the plank or otherwise transversely with the saw, which is made to revolve by means of the said strap wheels secured top and bottom, and tightened thereon by set screws or otherwise. *Patent abandoned.*

86. W. Grove. *Improvements in apparatus for sawing wood and other substances.* Dated January 10, 1863.

This invention has reference to the mode of mounting and employing circular saws for cutting or shaping wood, or otherwise rendering the same available for the general purpose to which such apparatus is or may be employed, and consists in arranging the said saws so as to receive motion direct from the axis upon which the fly-wheel is mounted through the intervention of tooth and pinion, or strap wheel gear, in such manner as to admit of being worked by the hands or feet, and regulated or adjusted to the required speed. *Patent abandoned.*

87. R. Luthy. *Improvements in hydrostatic presses.* Dated January 10, 1863.

This invention relates—1, To presses in which the piston or ram has to pass through the whole length of the stroke or lift, and consists in raising or moving the ram through the first or principal part of the stroke by means of a screw or screws, or by rack and pinion motion, or by other suitable mechanism; but the patentee prefers to use one or more smaller hydraulic rams for effecting this object. The said mechanism or apparatus may be connected with the press piston or larger ram through the press plate commonly called follower, or it may be made to act upon a rod passing through the bottom of the cylinder, and bearing direct upon the ram. 2, The improvements relate to those hydraulic presses in which the stroke of the larger ram may be shorter than the lift required for the whole operation. For this purpose the patentee proposes to effect the first part of the stroke by means of a cylinder and ram of the requisite length, but small diameter, and therefore of comparatively small weight. 3, The improvements relate to apparatus for supporting the platform or follower, or the cylinder and rams upon which the material to be compressed rests; for instance, when the small ram has completed its stroke. These apparatus consist, again, in small hydraulic cylinders, into which the fluid is allowed to enter, whilst their rams attached to the follower rise through the first part of the stroke. When the rams are not in motion, the suction valves will close and prevent the escape of the fluid, which will now support the pressure or weight resting upon them. *Patent completed.*

88. M. Vogl. *An improved fastening for bags and other articles.* Dated January 10, 1863.

This invention consists in constructing a fastening in the following manner:—One of the engaging members or portions of this fastening consists of a catch, hook, pin, notched arm, or piece fixed or formed on an arched, bent, or two-limbed piece, or, as the patentee calls it, a bridge piece, the two limbs of which work in or through a box case or frame in which is a spring or springs. The catch engages and disengages a recess, staple, socket piece, or part forming the other engaging member or portion of the fastening. These two members or portions of the fastening when engaged effect the fastening action, and they are kept engaged by the pressure of the springs on the limbs of the bridge piece, and they are disengaged by pressing the bridge piece downward or against the spring or springs. In applying the fastening to bags and like articles the patentee preferably arranges the engaging parts on the outside or upper side of the bag frame, and not on the inside or under side thereof, and he places the catch bridge piece and springs on one jaw of the frame, and the other engaging member on the other jaw. He prefers to shape the case which holds the springs like the box or case of a padlock. *Patent completed.*

89. L. H. E. Lepreux. *Improved hygrometric plates proof against salt-petrous humidity.* (A communication.) Dated January 10, 1863.

The object of these plates or slabs is to preserve apartments from the effects of damp. Placed on the inside of a wall even contiguous to a reservoir full of water, or the stones of which soaked with water are already salt-petred, they will preserve the hangings or tapestries from damage or dilapidation. They may at pleasure be prepared and arranged to receive a coating of plaster or mortar, paintings or paper hangings, and are composed of resin, plaster, sand, and gravel or flint, in about the following proportions—say, for a slab of one superficial yard, 8 lb. of resin, 8 lb. of plaster, 8 lb. of sand, and 48 lb. of gravel or flint. In laying or fixing these slabs a martingal or tiepiece is placed at each joint, which is closed with some of the same composition as that of the slabs, which thus united form one whole secured to the wall by cramps or claws galvanized to prevent oxidation. Plinths and foundations for walls may be made of the same compositon. *Patent abandoned.*

90. F. Fenton. *Improvements in the manufacture of pulp for paper-making and similar purposes.* Dated January 10, 1863.

This invention consists in preparing exhausted tan, tanners' waste, the bark of oak, elder, elm, lime (or linden), willow, and poplar trees into paper pulp or half-stuff for the manufacture of paper, cardboard, and papier mache. *Patent completed.*

91. E. Powers and J. G. Dale. *Improvements in the manufacture of caustic soda and potash, and carbonates, chromates, and stannates of the same alkalies.* Dated January 10, 1863.

In the manufacture of caustic soda and potash the inventors produce those substances direct from the chlorides by treating them with steam as it is evolved or superheated. The method they adopt is to place the chloride in a suitable vessel, so that the material may be heated and fused, and they then cause the steam to pass through the mass by means of a pipe which dips downward, or by other suitable arrangement, which will after the same manner bring the steam into immediate connection with the chloride. To assist the conversion into caustic alkali they propose, if found necessary, to add metallic iron, or oxide of iron, alumina, manganese, or other suitable metals or metallic oxides. When they desire by this process to produce carbonates of the alkalies, they combine a jet of carbonic acid with the steam; or if chromates or stannates be desired, they substitute for the metals above alluded to chrome iron ore, or oxide of chromium, or tin stone, or metallic tin, as the case may be. *Patent abandoned.*

92. D. Dawson. *Improvements in manufacturing magenta colour or dye.* Dated January 12, 1863.

In carrying out this invention, the patentee mixes a solution of arsenic acid with aniline in equivalent proportions, so that a neutral salt of arseniate of aniline is formed. The solution of arsenic acid is such that it contains from 23 to 30 per cent. of water, including water of hydration. The acid containing 23 per cent. of water is liable to deposit crystals, but they may be used along with the mother liquor, as arseniate of aniline will in that case be formed as well as if the arsenic had been all in solution. When the mixture is made and cooled, it is a solid substance, usually white, having a somewhat crystalline aspect. This substance contains all the water which held the arsenic acid in solution, perhaps as water of crystallization. The

patentee then puts this arseniate of aniline (plus water) into a strong iron cylinder capable of resisting a pressure of about 200 lb. on the square inch. The cylinder is provided with an air-tight fitting lid, in which a pressure guage is inserted. He now bolts the lid on. The cylinder being prepared as above, he places it in a bath capable of being raised up to the temperature of from 350 deg. to 360 deg. Fahr. The bath he now raises up to a temperature of about 345 deg. or 350 deg., by applying heat by a sand bath, or by a naked fire; care must be taken to keep the temperature about 345 deg. or 350 deg. Fahr. for the space of about 12 hours. He does not confine himself exactly to 12 hours, as the time necessary for producing the required result will vary according to the size of the apparatus. The pressure will get up as high as from 70 lb. to 100 lb. on the square inch. He has now produced the colour, and it only needs taking out of the cylinder and purifying by some well-known method. *Patent completed.*

93. E. D. Chattaway. *Improvements in railway signals.* Dated January 12, 1863.

This invention consists—1, In adapting the cord and bell or cord and whistle arrangement or signal at present in use for enabling the guard of a train to communicate with the engine driver so as at the will of the guard to convert such arrangement into an electro-galvanic or electro-magnetic signal. This the inventor proposes to effect by enclosing copper or other suitable wire or wires, properly insulated in the cord of the arrangement before referred to, and connecting the same with a galvanic battery or magnetic apparatus in the guard's van. 2, In constructing railway semaphore and other similar signals of sheet iron, either coated or not coated with vitreous enamel, or other similar material. *Patent abandoned.*

94. E. Stevens. *Improvements in ovens, hot plates, and cooking apparatus.* Dated January 12, 1863.

This invention is not described apart from the drawings. *Patent completed.*

95. W. Clark. *Improvements in winding or copping frames.* (A communication.) Dated January 12, 1863.

This invention relates—1, To the employment of a fixed apparatus for lowering the faller to the point of the spindles in winding or copping machines, and at the same time stretching or keeping in a fixed position the chain, cord, or other intermediate apparatus between the scroll or pointer barrel and the faller before the pointing and during the latter portion of the motion of the carriage only. 2, In the application of a double pulley or variable connection between the faller and the ratchet pointer, situate on the shaft of the drum spindles, in order that the course of the faller shall be always in the required relation with the number of turns of the spindles during the pointing. 3, In the employment as an intermediate agent between the apparatus conducting the faller (rule or copping plate) and the faller of a combination of parts knee-jointed and constructed in such manner that the projections on the spindle and the spaces traversed by the faller may be proportionate to the variations of the conducting apparatus. *Patent abandoned.*

96. W. Clark. *Improvements in carding engines.* (A communication.) Dated January 12, 1863.

This invention consists in substituting for the reciprocating roller of the large cylinder in carding engines a flyer with continuous motion, which, instead of stripping the large cylinder in front of the doffer, effects the said operation in front of the feed rollers, at a point before the cylinder arrives at the feed roller, whether it is furnished with a licker-in or not, and after the doffer has acted. *Patent abandoned.*

97. W. Clark. *Improvements in the preparation of green colouring matter.* (A communication.) Dated January 12, 1863.

The inventor claims the preparation of a green colouring matter derived from aniline, which is soluble and suitable for dyeing and printing purposes, by means of a combination of reducing agents, such as hydrates and soluble hyposulphites acting on acidulated solutions of salt and rosaniline, or on the blue or violet compounds derivable from the same. *Patent completed.*

98. A. I. Mahon. *Improvements in screw and paddle propellers, and a submarine propeller, also applicable to the raising and forcing of water or other fluids.* Dated January 12, 1863.

This invention relates to various forms of screws and screw blades, and their combination and arrangement, so that the vacuum caused by the ordinary working of their different currents may be taken advantage of, and so that the centres of screws may be made to work more effectively, and for the employment of the principle that the natural tendency of water is to overcome vacuum, whether produced artificially or not, in the form of a propeller that may combine the advantages of the paddle and screw, and which may be called a paddle. *Patent abandoned.*

99. W. E. Newton. *Improvements in the application of power designed for stationary and traction engines, propellers, and other machinery.* (A communication.) Dated January 12, 1863.

This invention relates to the employment of a system of dogs or driving catches for operating upon the interior of the rim of a wheel or pulley for the purpose of producing its rotary motion. These dogs or driving catches are arranged in two sets, and are applied in connection with a lever or levers arranged to oscillate upon the shaft of the wheel or pulley, so that in the movement of each of the levers in one direction the dogs will work free of the rim, and in its movement in the opposite direction, they will bite the rim, and thereby transmit a rotary motion to the wheel or pulley, and to its shaft. This part of the invention consists in certain devices employed in connection with this double system of dogs to provide for the reversal of the rotary motion at pleasure. The invention further relates to a certain means employed for varying the application of the driving power, whereby, when required, speed may be decreased, and a proportionate increase of power obtained, and the utmost capacity as regards speed obtained when desired, and a steam engine rendered capable of being used as either a traction or stationary engine. *Patent completed.*

100. T. G. Lewis. *Improvements in apparatus applied to perambulators, invalid chairs, and other carriages.* Dated January 13, 1863.

This invention relates to the application of moveable arms to perambulators, invalid and other carriages, for the purpose of holding or supporting children, invalids, and other persons in such vehicles, and also to offer support or rest for the arms. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated May 27, 1863.

1328. A. P. Hernandez and P. B. Crespy, Bordeaux, France. Improvements in the manufacture of soap.

Dated June 22, 1863.

1562. E. Wilks, portmanteau-maker, Cheltenham. Improvements in making portmanteaus and trunks of various shapes and sizes, light, strong, air-tight, and water-tight, capable of bearing immersion in water without injuring the contents.

1565. W. Snell, 16, Clement's-inn, Strand. Improvements in arrow-shaped projectiles, and in guns for discharging the same.

Dated June 24, 1863.

1591. P. R. Hodge, 25, Cannon-street, City, civil engineer. Improved floating hydrostatic machinery adapted to presses, dry docks, slips, or the moving or lifting of heavy masses, parts of which are applicable to the expressing of oil or other fluids.

1593. S. Smith, 5, Fell-street, City. Improvements in the manufacture of liquorice, and in the means or apparatus employed therein.

Dated June 29, 1863.

1619. G. Davies, 1, Serle-street, civil engineer. An improved cork-cutting machine.

Dated July 2, 1863.

1651. J. King, Chadshunt Farm, near Kineton, Warwick. Improvements in fencing land and in hanging gates.

Dated July 4, 1863.

1664. R. Flude and J. Farndon, Aylestone-street, Leicester. Improvements in looms for weaving narrow fabrics.

Dated July 6, 1863.

1675. T. W. Couldery, Old Kent-road. Improved means of attaching boxes or receptacles to hold soap, black lead, or similar household articles to the sides of wash-tubs, pails, or house boxes.

1677. S. J. Cooke, 2, St. Michael's-house, Cornhill. Improvements in apparatus for supplying carbonic acid gas to casks or other vessels containing beer or other fermented liquid. (A communication.)

1679. B. Bonfield, Forest-hill, commercial traveller. Improvements in stoppers for bottles.

Dated July 7, 1863.

1682. L. J. Guichard and G. F. J. Lefebvre, 10, Rue de la Fidélité, Paris. Improvements in lamps, and in the wicks used in such lamps.

1683. W. S. Bruce, Great St. Helen's, Bishopsgate-street. Improvements in lucifer matches, fusees, and other similar lights, and in the boxes or holders for containing the same. (A communication.)

1685. G. Bartholomew, Linlithgow, edge tool maker. Improvements in shoes for the feet of horses and other animals, and in the means of connecting them.

1689. S. Robinson, 129, Great Brunswick-street, Dublin. Improvements in spring hinges for swing doors.

Dated July 8, 1863.

1691. E. Myers, Millbank-row, civil engineer, and H. Forbes, 6, Aberdeen-place, Maida-hill. An improved method of propelling and steering ships.

1693. W. Basford, Pewsey, Wilts, engineer. Improvements in apparatus for generating and purifying gas made from coal or other bituminous substances.

1697. P. A. L. de Fontainemoreau, 10, Rue de la Fidélité, Paris. A new mode of roofing houses, buildings, and other structures. (A communication.)

1699. A. G. Southby, Bradford, Wilts, engineer. Improvements in divers lamps.

1703. H. D. P. Cunningham, Bury, Hants, esquire. Improvements in working guns, and in matters relating thereto.

Dated July 9, 1863.

1705. S. Davis, 33, Strand, saddler and harness manufacturer. An improved anatomical bit for horses or other animals. (A communication.)

1706. J. Smith, Berkeley-house, Seaforth, Liverpool, and S. A. Chease, Egremont, Chester. A new description of hydraulic engine for raising water and other fluids above their common level, the fluids so raised to be used as a motive power.

1707. W. Williams, Gutter-lane, Cheapside. Improvements in shirt collars and boys' and ladies' collars.

1709. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in ships and in propelling the same. (A communication.)

1711. J. F. Delany and J. C. R. Okes, Victoria Foundry, Greenwich. Improvements in the pistons of steam engines.

1715. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in barometers or gauges for measuring the pressure of fluids. (A communication.)

1717. G. Gowland, Liverpool, chronometer-maker. Improvements in the construction and arrangement of nautical and surveying instruments for measuring angles and altitudes.

Dated July 10, 1863.

1719. P. A. Godefroy, 7, Shepherd's-lane, Homerton, operative chemist. Improvements in the mode of purifying oils.

1721. M. A. F. Mennons, Abingdon Chambers, Westminster. Improvements in the mode of preserving and protecting the silvering of mirrors. (A communication.)

1723. C. de Bergue, Strangeways Works, Manchester, engineer. Improvements in piles for foundations, and in piers for bridges and other buildings or structures.

1727. W. E. Jones, 22, Wellington-road, Clapham, civil engineer. Improvements in the permanent way of railways.

1729. J. P. Bourquin, Newman-street, Oxford-street, manufacturer of photographic goods. An improved construction of rolling press.

1731. R. H. and W. Hawthorn, Newcastle-upon-Tyne, engineers. Improvements in the working of railways.

Dated July 11, 1863.

1733. E. D. Chattaway, New Broad-street, London, engineer. Improvements in railway signals.

1737. J. Barnes, Nottingham, mechanic. A new machine for clipping off connecting threads in the manufacture of lace.

Dated July 13, 1863.

1741. R. D. Dwyer, Warrington, engineer. Improvements in the construction of vents for casks and other vessels.

1745. J. Barton, Alfreton, Derby, colliery manager and coal merchant. An improved guard or fence for coal, iron, stone, or other pits, warehouse or other lifts, sack-holes, or other places requiring a guard or fence.

1747. G. H. Barber, Southampton, accountant. An improved calendar or date-denoting apparatus.

1748. J. Laing, 80, George-street, Manchester, drysalter. Improvements in dyeing or printing. (A communication.)

1751. P. C. A. Iodocius, Dunkerque, France, merchant. Improvements in fishing, and in the apparatus or means to be employed therein. (A communication.)

Dated July 14, 1863.

1753. L. M. Bouruique, mechanician, and J. B. Vidard, engineer, Paris. Certain improvements in railway carriages.

1754. L. M. Bouruique, mechanician, and J. B. Vidard, engineer, Paris. An improved waggon or truck to be used on railways.

1755. J. R. Cooper, Birmingham, gun manufacturer. Improvements in sights for rifles and other firearms.

1757. J. T. Cooke, Leicester, batten maker. Improvements in and connected with battens for driving shuttles from side to side of their work in weaving.

1759. G. Saxon, Openshaw, engineer. Improvements in metallic pistons.

1761. R. Hornsby and J. E. Phillips, Spittlegate Iron Works, Grantham. Improvements in reaping and mowing machines.

1763. E. Sonstadt, Loughborough. Improvements in the manufacture of sodium.

1767. E. Funnell, Brighton, watch and clock maker. A self-acting electro-magnetic clock-work signal for railway purposes.

1771. W. Clark, 53, Chancery-lane, engineer. An improved process for making paper transparent and transferring designs. (A communication.)

1773. M. Henry, 84, Fleet-street. Improvements in figuring, ornamenting, and colouring fulled and felted fabrics and articles. (A communication.)

1775. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in apparatus for telegraphing by electricity. (A communication.)

1777. D. Tamet, 103, Vieille Route à Neuilly sur Seine, France. Improvements in breakwaters and in the construction of rail and other ways thereon.

Dated July 15, 1863.

1779. A. Watson, Glasgow, stove grate manufacturer. Improvements in cooking ranges.

1781. J. N. Taylor, Brixton, Retired Admiral, and W. Austin, Milford, South Wales, civil engineer. Improvements in the construction of ships and other floating bodies.

1783. L. Priestley, Bradford, and J. Todd, Morley. Improvements in the manufacture of elastic boots and shoes and in apparatus used therefor.

1789. B. Lambert, 35, Lothian-road, Camberwell New-road. Improvements in the preparation of waste paper in order to its being again used in the manufacture of paper.

1791. N. Thompson, 15, Abbey-gardens, St. John's-wood, Middlesex. Improvements in boat-building, and in machinery for shaping wood therefor.

Dated July 17, 1863.

1793. A. J. Sedley, 210, Regent-street, London, upholsterer. Improvements in the canopies of bedsteads of metal or wood, or both combined, and other articles of furniture used to sit or recline upon.

1796. F. Lepoutre, Tourcoing, France, manufacturer. A new mechanical sector applicable to all self-acting machinery used for spinning textile fabrics.

1797. T. Johnson, Hadleigh, Suffolk, engineer. Improvements in machinery for washing and cleansing casks.

1799. R. A. Brooman, 166, Fleet-street, patent agent. An improved varnish for preserving metal and wood. (A communication.)

1801. R. Coenen, 19, Old Broad-street, City, silk merchant. Improvements in machinery for winding, measuring, and sizing silk. (A communication.)

1802. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in machine knitting needles, and in machinery or apparatus for making the same. (A communication.)

Dated July 18, 1863.

1803. A. Clark, Gate-street, Lincoln's-inn-fields, engineer. Improvements in revolving shutters and blinds, and in apparatus for the manufacture of the same.

1804. W. C. Page, Gabrick-street, Millwall, engine

driver. An improved mode of preventing and removing the incrustations in marine and land steam boilers.

1806. E. Holborow, Buckingham-street, Fitzroy-square, and I. Parker, Houghton-street, Clare-market. Improvements in the construction of sights for firearms.

1807. F. J. Mavor, Park-street, Grosvenor-square, veterinary surgeon. Improvements in horse shoes.

Dated July 20, 1863.

1809. F. A. Calvert, Manchester, engineer. Improvements in machinery for opening, cleaning, and preparing fibrous substances.

1811. T. Knowles, Hulme, gentleman. Improvements in machinery for opening, carding, and cleaning cotton and other fibrous materials when in a manufactured or partly manufactured state.

1813. A. Smith, Stratford, brush manufacturer. Improvements in machinery for dragging bristles, applicable also to drawing or sorting fibres and hair into different lengths.

1815. A. A. Pelaz, Lyons, France, gentleman. Certain improvements in printing stuffs and other fibrous fabrics.

1817. J. Lyman, Thavies-inn, civil engineer. Improvements in micrometer draughting scales.

1819. J. Goold, Corsham, Wilts, tanner. Improvements in the manufacture of ink.

Dated July 21, 1863.

1820. F. L. H. Danchell, Red Lion-square, civil engineer. Certain improvements in apparatus for purifying water.

1823. W. L. Aberdeen, Belfast, mill manager. Improved machinery for breaking or softening and preparing flax, hemp, jute, tow, and other fibrous substances.

1825. E. T. Bainbridge, St. Paul's-churchyard. Improvements in ventilators.

1827. G. Haseltine, Southampton-buildings, Chancery-lane, civil engineer. An improved implement for harrowing and smoothing land. (A communication.)

1829. E. Alcan, King-street, merchant. Improvements in apparatus for condensing steam. (A communication.)

1831. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the manufacture of mats, floor cloths, or coverings for floors, straps, bands, ropes, and other analogous articles which are usually made of textile or fibrous materials. (A communication.)

Dated July 22, 1863.

1835. J. White, Trinity-street, Trinity-square, manufacturer. Improvements in pyramid and other cans or feeders for oils and other liquids.

1836. C. Beslay, Rue Menilmontant, Paris, gentleman. Improvements in making all woven and thready fabrics waterproof. (A communication.)

1839. J. Simmons, Rainham, Sittingbourne, agricultural implement maker. Improvements in ploughs.

Dated July 24, 1863.

1850. J. Kirkland, Liverpool, engineer, improvements in apparatus for working hydraulic presses.

1852. A. English, Hatfield, Herts, inspector of police. Improvements in apparatus for securing and protecting horses and other cattle during their transit by rail and other ways, and on board ship.

1854. B. Birnbaum, 21, New Broad-street. Improvements in gaiters and leggings.

Dated July 25, 1863.

1856. G. H., J. M., and J. James, 10, Dyer's-buildings, Holborn. Improvements in the manufacture of covers for purses, wallets, and pocket-books.

1860. C. Crockford, Greenfield Spelter Works, Holywell, Flintshire, smelter. Improvements in the treatment and utilization of certain of the waste products from the manufacture of alkali and bleaching powder, and also from certain smelting operations.

Dated July 27, 1863.

1862. W. Tranter, Birmingham, gunmaker. Improvements in breech-loading and other revolving firearms.

1864. T. Thorne, Southsea, Hants, carpenter. Improved apparatus for disengaging ships' boats.

1866. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in sleepers or supports for the rails of railways. (A communication.)

1868. J. Whittaker, Mons Mill with Walton-le-Dale, Lancaster, millwright. Improvements in engines for obtaining motive power by steam, air, or any other vapour.

Dated July 28, 1863.

1874. J. Jewell, Devoran, near Truro, Cornwall. Improvements in setting boilers.

Dated July 29, 1863.

1876. J. Sainty, Burnham Market, Norfolk, agricultural engineer. Improvements in the construction of feeding troughs for sheep and other cattle.

1878. N. Thompson, Abbey-gardens, St. John's Wood. Improvements in apparatus for stopping the bung-holes of casks and similar vessels, also in tools or implements for fixing and removing such stopping apparatus.

1880. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. An improved self-acting flushing apparatus. (A communication.)

1882. E. Sturge, Walworth, engineer. Improvements in coating or protecting metallic surfaces.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated July 31, 1863.

1900. R. Stewart, Elmira, New York. Improvements in operating the cut-off valves of steam engines.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, August 11, 1863.

813. W. Symonds. Barometers.
814. G. Thomas. Window shutters and blinds.
820. J. Carver. Carriages employed in machines for making lace.
824. E. T. Hughes. Composition for rendering cloth, paper, and similar articles transparent and waterproof. (A communication.)
826. A. B. D. Maurand. Apparatus for bringing the former weights and measures into those of the present decimal system most easily and precisely and *vice versa*.
835. J. Hindle, W. F. Calvert, and E. Thornton. Looms.
836. I. Rowland. Mileage apparatus.
837. J. Bray. Omnibuses and railway carriages.
841. W. Mitchell. Coating iron. (A communication.)
850. J. J. Potel. Furnaces and fireplaces.
854. A. B. Seithen. Casings or covers for bottles or jars.
856. J. Blain. Threads and yarns.
857. P. Hanrez. Drying coal, grain, and other substances.
870. J. Burwin. Pickers.
877. J. H. Johnson. Polishing precious stones. (A communication.)
884. J. Mosheimer. Crushing, grinding, and dressing metallic ores.
890. J. L. Norton. Washing and drying wool.
891. A. Kinder. Coating or covering lead.
910. R. Smith. Medicated oil.
940. R. A. Brooman. Hardening and colouring gypseous limestone and sand. (A communication.)
941. R. A. Brooman. Lamps. (A communication.)
943. J. Leach. Machine for washing, squeezing, mangling, and churning.
948. A. Marriott. Boilers for heating buildings.
960. A. Samuelson. Apparatus for the manufacture of oil.
1011. W. Clark. Tiles. (A communication.)
1012. T. Richardson and J. C. Stevenson. Sulphate of soda.
1063. A. Kinder. Manufacture of sheet metal.
1106. J. B. Dubreuil. Carts, waggons, and other vehicles.
1161. J. Stickland. Laying veneers on to surfaces.
1197. R. A. Brooman. Preparing, dressing, and winding cotton, woollen, flax, silk, and other warps. (A communication.)
1262. J. Coignard. Sewing machines.
1389. F. S. Barff. Preserving and hardening surfaces of brick, cement, stone, and stucco.
1485. J. S. Benson and D. Jones. Removeable head for casks.
1748. J. Laing. Dyeing and printing. (A communication.)
1826. J. E. Vanner. Umbrellas and parasols.
1844. G. Davies. Firearms. (A communication.)
1862. W. Tranter. Breech-loading and other firearms.
1900. R. Stewart. Valves of steam engines.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 10, 1863.

388. J. Jones.
392. W. Robertson.
393. G. Wrigley & S. Morris
394. O. H. Hodge.
401. J. S. Gisborne and W. Simpson.
410. J. and H. Higgins.
415. J. W. Crossley.
416. C. D. Abel.
420. R. A. Brooman.
423. S. W. Clough.
424. W. Nalder.
426. T. W. Salmon.
513. G. Bower and W. Hollinshead.
528. T. V. Lee.
561. J. H. Johnson.
708. W. E. Newton.
808. B. W. Goode.
903. G. Low.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1889. R. Bodmer.
1908. R. A. Brooman.
1923. M. Dobbs.
1926. G. H. Newton and A. Wild.
1945. R. Smith.
1965. N. Wehnert.
2015. E. Hall.
2046. G. Kershaw.
2052. E. T. Truman.
2055. R. Jobson and R. J. Ransome.
2088. R. Perrott, jun., and J. Molony.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1840. H. W. Wood.
1854. J. Y. Borland.
1876. T. Whittaker.
1885. J. Cartland.
2006. B. A. Grautoff and C. H. W. Albrecht.

LIST OF SPECIFICATIONS PUBLISHED
For the Week ending August 8, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
3421	0 4	3463	0 8	3471	0 4	3476	0 8	3481	0 8	3486	0 4
3443	6 8	3466	0 4	3472	0 6	3477	0 8	3482	1 0	3487	0 4
3453	1 0	3467	0 4	3473	0 10	3478	2 0	3483	0 4	3488	0 4
3454	0 4	3468	0 4	3474	0 8	3479	1 4	3484	0 4	3489	0 8
3457	0 4	3469	0 8	3475	0 8	3480	0 4	3485	0 6	3490	0 4
3458	0 4	3470	2 4								

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LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£ s. d.		£ s. d.	p. ct.
Iron:—					
Welsh Bars, in London	per ton	6 10 0	to	6 15 0	2½
Nail Rods	do	7 5 0		7 10 0	
Hoops	do	8 5 0		8 15 0	
Sheets, single	do	9 5 0		9 15 0	
Staffordshire Bars	do	7 10 0		8 0 0	
Bars, in Wales	do	5 10 0		6 2 6	
Rails	do	5 15 0		6 0 0	net
Foundry Pigs, at Glasg, No 1	do	2 13 6		2 18 0	
Swedish Bars	do	11 10 0		12 0 0	2½
Steel:—					
Swedish Keg, hammered	do	16 0 0		0 0 0	
Swedish Faggot	do	17 0 0		18 0 0	
Copper:—					
Sheet & Sheathing, & Bolts	do	99 0 0		0 0 0	
Hammered Bottoms	do	109 0 0		0 0 0	
Flat Bottoms, not Hamrd	do	112 0 0		0 0 0	
Tough Cake and Ingot	do	95 0 0		0 0 0	
Tile Copper	do	89 0 0		0 0 0	
Best Selected	do	98 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8¼		0 0 8½	
Fine Foreign	per ton	93 0 0		100 0 0	
Tin:—					
English Block	per cwt.	5 18 0		0 0 0	2½
do Bar	do	5 19 0		0 0 0	
do Refined	do	6 4 0		0 0 0	
Banca	do	6 6 0		0 0 0	
Straits	do	6 1 0		6 2 0	
Tin Plates:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 6	
Second Quality	do	1 7 0		1 7 6	
Coke	do	1 3 0		1 4 0	
Lead:—					
Pig, English	per ton	20 2 6		21 10 0	2½
„ Spanish Soft	do	19 17 6		19 10 0	
Shot, Patent	do	23 10 0		0 0 0	
Sheet	do	21 0 0		0 0 0	
White	do	27 0 0		27 10 0	

Timber, duty 1s. per load, drawback 1s.

	£ s.	£ s.
Teak ... load	£12 0	£13 0
Quebec, red pine	3 10	4 10
„ yellow pine	3 10	4 10
St. John, N.B., yellow	0 0	0 0
Quebec oak, white	5 10	6 10
„ birch	3 10	4 10
„ elm	3 10	5 0
Dantzic oak	3 10	6 10
„ fir	2 10	3 10
Memel fir	3 5	3 10
Riga	3 0	3 5
Swedish	2 10	2 15
Masts, Quebec red pine	5 0	0 0
„ yellow pine	5 0	6 0
Lathwood, Dantzic, fm	5 10	6 10
„ St. Petersburg	8 0	8 10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.		
Quebec, white spruce	15 10	18 10
St. John, white spruce	14 0	15 10
Yellow pine, per reduced C.		
Canada, 1st qual.	17 0	18 0
„ 2nd do.	11 0	12 0
Archangel, yellow	£13 0	£13 10
St. Petersburgh, yel.	11 10	12 0
Finlan	9 0	10 0
Memel	10 0	15 0
Gothenburg, yellow	10 0	11 0
„ white	9 0	9 10
Gefle, yellow	10 10	11 10
Soderhamn	9 10	10 10
Christiania, per C., 12ft. by 3 by 9 in.		
Christiania, yellow	21 0	23 0
Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 4
Pumice Stone pr ton	5 10	9 0
Oils, &c.		
Seal, pale ... per tun	46 10	0 0
Sperm body	81 0	82 0
Cod	54 0	0 0
Whale, Sth Sea, pale	44 0	0 0
Olive, Gallipoli	60 0	0 0
Cocoanut, Cochin	49 0	44 15
Palm, fine	36 10	37 0
Linseed	44 10	44 15
Rapeseed Eng. pale	45 0	0 0
Cottonseed	33 0	40 0

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THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 21, 1863.

THE ENGINES OF OUR NAVY.

It is very unlikely that the contest between guns and armour-plates will soon be brought to a satisfactory termination. Ordnance of every possible construction, is employed with varying success to pierce or shatter targets, in which iron is combined, and built up with all sorts of materials from papier maché to steel. Armstrong, Whitworth, and Co., and their supporters, still do their best to prove the whole system of iron-plating fallacious. Money is expended with no niggard hand, nor is it likely that the country will refuse supplies, until the experiments have attained some definite result, some fixed point which will serve to guide us in our future proceedings. Still, it is improbable that such a result will be reached for many months, if not years, to come. Just now, we cannot consider the best form for a fighting ship as being settled conclusively, or even approximately; nor yet her size; while the description of guns with which she is to fight, and the kind of armour to protect them, are equally matters of opinion, hitherto decided on, far more frequently from conjectural reasons, than because of those which follow as natural deductions from experience. That matters will improve, and that ere long we will thoroughly understand which is the best gun, and the best ship, and the best armour, and the best of many other things connected with our Navy, we do not doubt; but the most careful and disinterested investigation fails as yet to discover any result from all this expenditure of money, and talent, and discussion, which does not admit of dispute save one, which is, that the ship capable of steaming fastest and manœuvring most readily, is, other things being pretty equal, the best for all the purposes of attack and defence. This sole qualification of speed, indeed, may compensate very well for defective ordnance, inferior armour, a weak crew, or a hundred other things which might, without it, render a war ship comparatively inefficient as such. However much engineers and sailors may disagree on other points, on this at least they are agreeably unanimous. It is quite true, that an iron-plated ship may be employed with advantage in many situations where speed is in no wise necessary to her, or at least can be very well dispensed with, whilst she is fulfilling her legitimate purpose, as in attacking a fort; still, even the so-called floating batteries, built expressly for such an object, would be none the worse could they steam 14 or 15 knots an hour in a sea-way when occasion required, as well as lie quietly in one place to shoot, and be shot at; and what holds true of such vessels as these, applies with equal force to every ship in the Navy. The excessive weight of their armour, their guns, their propelling machinery, and the fuel required for a few days' cruise has effectually kept the speed of our iron-plated frigates, great as it is, below the attainable limit, and even while the gun and armour question is carried on with a spirit and energy which will, we trust, lead to highly satisfactory results, it might be as well perhaps that the Government, instead of concentrating all its powers on a problem which is no longer new, should devote yet a little more of their attention to the best means of attaining the high speed, which will enhance every advantage to be derived from the best possible guns, and the most perfect system of iron-plating.

Reliable calculations which would give us the average speeds of the principal steam navies of the world would be very valuable. Similar information respecting the mercantile steam marine of different nations would not be less so. The necessary data, however, are not in existence, or not available. We have, it is true, returns more or less accurate of our own ships and their performances, and this is about the limit of our knowledge on such subjects. It is quite enough to prove that the speed of our Navy, at all events, is below that maintained by the fleets of our steam-ship companies, who could easily select dozens of ships which would beat the fastest frigates, screw or paddle, we have afloat. The mail-boats from Kingstown to Holyhead can manage 20·5 statute miles an hour now and then. The "Victoria and Albert's" speed is over 19 miles an hour. The "Pera" has averaged 17·5 in a run of 1,000 miles from Malta to Alexandria. The river boats on the Clyde, small as they are, can perform over 20 miles per hour, trip for trip. We might fill this column with a mere list of the names of steam-ships not in our Navy, which exceed in speed, by a couple of knots an hour, the fastest frigates in it. We do not wish to make this comparison in an invidious sense. We cite such facts to remind our readers of the possibility of attaining a far higher speed than anything our fighting ships have yet displayed.

When dealing with this question we must, however, bear in mind that whatever theorists may say, there is for the present a certain practical limit to the speed of a ship; a limit which can only be exceeded by having recourse to certain exceptional arrangements, which entail the sacrifice of many other things which ships, as a rule, cannot dispense with. A speed of 20 miles an hour is about the maximum which can be realized satisfactorily. With such a velocity we have good reason to rest content. Without going to this limit, we find a large class of merchant steamers accomplishing 18 miles per hour with ease and certainty, and it becomes, for various reasons, a matter for serious consideration, that some at least of our "crack" iron-plated frigates should be constructed and engined to attain a like speed when occasion required. In the third report of the British Association on Steam-ship Performance, we find that the speed of the "Duncan" is stated as being 13·33; that of the "Victoria," 13·14; of the "Howe," 13·56; "Mersey," 13·29; and "Orlando," 13·16 knots per hour. To this we may add the "Warrior," 14·3; and the "Royal Oak, 12·5." This list includes the fastest ships of war we have afloat, the great mass of our Navy being far—we are afraid to say how far—inferior in speed. Things are somewhat altered since the palmy days of sailing ships, when our frigates ranked amongst their number the fastest craft which went to sea. Then these ships had, as a rule, to wait for the convoy they protected. We much question that such would be the case in the event of a modern war. Many of our clipper sailing ships, with and without auxiliary engines, can sail faster than the vessels which would be available as escorts; and the man-of-war deputed to watch over and protect a fleet of merchant steamers would need to be carefully selected, in order to fulfil her duties as she ought. The increase in speed in our Navy has not kept pace with that of our trading ships; too much, possibly, being thought of armament, and too little of that speed which is essential to its proper use; and this, while recent events demonstrate that escort frigates cannot yet be dispensed with in warfare.

It is fortunate that the relative merits of paddles and screws have been settled long since definitively. Had it not been so, we would have animated discussions and costly experiments on this subject, as well as on guns, targets, &c., to increase the complication of affairs. For once, however, that which is scientifically correct is practically so as well, and the screw reigns supreme over all other modes of propulsion for ships whose mission is war. Were it not so, the proportion of sailing ships in our Navy would have remained unavoidably large, for reasons well exemplified by our old paddle-wheel frigates; and we should have heard little of armour, but for submerged propellers.

The screw is in its infancy, as far as the Navy is concerned, inasmuch as we have not as yet availed ourselves of many important advantages which its use holds out. Doubled, as in the "Diana" or "Flora," it affords, apparently, the best of all means for manœuvring, without perhaps entailing any very great practical difficulties. Too little is as yet known about the application of this principle to large vessels to enable us to speak decidedly. It is just one of those inventions which promise well, and therefore it deserves careful consideration. The screw, however, in its present form indirectly supplies us with the means of increasing the speed of our ships without an increase in the consumption of fuel. We state this as a proposition which will scarcely be disputed by those who have given the subject due thought. The screw alone permits the legitimate use of high speed in the crank shaft, high pressure, and the extension of the principle of expansion to its proper limit; three elements sufficient in themselves to secure a very superior degree of economy to any they yet attempted generally in the Navy. The small number of strokes per minute in large paddle engines causes such a tedious isolation of the expanding steam in their cylinders, that no appliances available under the circumstances can prevent condensation to a degree which sets economy at defiance. For a like reason, it is impossible to realize anything like a high speed of piston, and in consequence power must be obtained by the use of enormous cylinders which should never find a place on ship-board. One thing is certain, although we have not nearly reached the maximum limit of size in our ships of war, we have in their engines; and we much more than doubt the possibility of forging a crank shaft, which would transmit 10,000-horse power when making but fifty revolutions per minute. Krupp's great steel ingot proves nothing to the contrary, our readers may rest assured. No one can fortell the dimensions of the ships we may see fit to build within the next ten years; and yet it is quite certain that any very great increase on what we have already accomplished, must entail a change in our engines, which those in authority never seem to contemplate.

We have already reminded our readers that a speed of twenty miles an hour has been realized by very many steam-ships; so many, indeed, that the velocity can scarcely be considered exceptional. A large proportion of our merchant steamers, although not coming within two or three knots per hour of this speed, are yet faster than our men-of-war, with one or two exceptions. It is urged, with much truth, that vessels built to fight, cannot compete with those built for speed. We will grant this to a certain extent; but even did we admit it in its entirety, it would still fail to prove a good argument for keeping speed were it now is, in the ships which we expect

to maintain the sovereignty of the seas. Our ships should be so engined that a speed of 16 knots would cease to be exceptional amongst them. It requires no very extensive alterations on existing arrangements to attain this end. The maximum amount of power to be obtained from a certain weight of machinery has never yet been determined, and we feel little hesitation in saying that 950 tons of it, as in the "Warrior," could easily develop, and transmit 10,000-horse power without risk. It is merely within certain limits, a question of piston speed, and the disposition and strength of materials. As to fuel, a 5,000-horse power engine should get on comfortably on 2·5 lb. of coal per horse-power per hour, and the fact that the engines of our Navy use nearly twice as much, proves nothing but their faulty construction. By the employment of simple engines, with small cylinders, and plenty of them; high pressure, say 50 lb. cut off at one-seventh of the stroke; good surface condensers and a speed of piston of, say 600 ft. per minute; superheating and steam-jacketing, there is no doubt that the consumption of fuel might be reduced by nearly one-half. And by driving the crank shaft by means of gearing, at a greater number of revolutions than the screw shaft, there would be no difficulty whatever in producing crank shafts large enough to transmit any power we pleased. The speed of our Navy is increasing; each ship we build is faster than the last, or intended to be so as a rule; and without due care we may arrive at a point where the marine engine builder will be unable to satisfy the demands made on him by the naval architect.

SUPERHEATED STEAM.

It is not very easy to say when the employment of steam, heated above the temperature due to its pressure, was first proposed as a means of economizing fuel. Like many other inventions or discoveries, it is claimed by several individuals, who certainly did not all hit on the idea simultaneously. The weight of evidence goes to show that superheated steam can trace its origin to America, where, some fifteen or twenty years ago, a Mr. Frost conducted some experiments on steam heated apart from water. These gave such remarkable results, that the attention of the Institute of Arts and Sciences at New York was called to the subject, which received further development at their hands. Subsequently, Dr. Haycraft, of Greenwich, made a number of experiments on what he termed "anhydrous steam." He tried his plans on an engine with a 9-in. cylinder and 3 ft. stroke with very considerable success. His apparatus burned out, however, from its faulty construction, and he appears to have abandoned further trials in disgust. Whatever the claims of rival inventors may be, it is certain that superheated steam was not brought prominently before the engineering world until 1856. In 1857, Mr. Penn's apparatus was fitted on board the "Valetta," with the immediate result of a saving of 20 per cent. in the consumption of fuel. Since then superheated steam has steadily advanced in public favour; indeed, it is far from improbable, that ere many years elapse, the employment of the principle will become all but universal in our steamships.

That a certain amount of economy must follow from the employment of superheated steam, is as plainly demonstrable as a mathematical proposition. What the *exact* amount may be, depends altogether on the construction of the engine and boiler, and the degree of expansion at which the engine is worked. It is almost needless to say that it can never arrive at the pitch which the first promoters of its application imagined. Frost and Haycraft considered it quite possible to expand steam sevenfold without raising its temperature much over 350 deg. That which is so obviously opposed to theory can never be correct in practice: the utmost saving of fuel which has yet been attained being 30 per cent., and this, be it remembered, only in cases where the boilers have been very defective, and failed to supply dry steam to the engines previously to the application of the superheater.

Steam not in contact with water, if quite dry, may be considered to expand in pretty nearly the same ratio, for successive increments of heat, as any of the fixed gases; or at the rate of 1-480th of its volume for each degree of Farenheit's thermometer. Thus, by heating it to 480 deg. above its own temperature, it would be doubled in volume, or, if confined, in pressure; but, it must be remembered, only at the loss of sufficient heat, to convert a body of water into as much steam as would be capable of performing more work, than that due to the increase in the volume, or pressure, of the steam superheated. The true sources of economy, are not be found in any such expansion—although that is of course useful, as far as it goes—but in the power superheating gives us of maintaining the temperature of the cylinder, valve chest, &c., at a very high point, and thus counteracting the cooling effects due to expansion; and also because all the free moisture or spray, which is suspended in a state of almost infinite subdivision in the steam, is vaporized in passing through the pipes of the superheater, and thus rendered available for the subsequent production of power in the cylinder. Thus, the best boilers show least gain from the employment of the principle when the engines do not work expansively, because they produce what is usually termed dry steam. Boilers of defective design, on the contrary, very frequently prime continuously; not sufficiently, it is true, to interfere with the working, or endanger the stability of the engines, but still quite enough to wasteful. Superheating invariably gives excellent results in such cases, both directly, in the saving of coal, and indirectly, by preventing the injurious action which dirty water always exerts on valve faces and pistons. The advantage to be derived in this way, however, is as nothing when compared with the facilities which superheated steam affords for carrying expansion to its maximum.

If we suppose steam of 60 lb. pressure admitted to a cylinder for one-sixth of the stroke, we shall find, that whereas its temperature on entrance was about 295 deg. Fahr., yet, on the completion of the stroke, it will, if the stroke is a long one, have fallen more than 70 degrees in consequence of its expansion. Be the cylinder ever so well protected outside, it being composed of comparatively thin metal, soon becomes cooled down to the temperature of the steam in contact with it. Thus, on the commencement of the next stroke, the steam, on entering, is at once chilled and condensed by contact with a metal surface nearly—from one source or another—100 degrees cooler than itself. The result is that expansion, under such circumstances, is a source of waste, instead of economy, because, had the steam been kept to full pressure nearly through the stroke, the cylinder would never have had time to cool sufficiently to do much harm. The fact of this loss of heat taking place in expanding, unless special provision is made to prevent it, is beautifully illustrated in Cornish engines without jackets, the pistons of which, though perfectly tight when near the bottom of the cylinder, are frequently found to blow through at the commencement of the down stroke, from the fact that the upper part of the cylinder is permanently larger in diameter, owing to its higher temperature, than it is near the bottom, where only cooler steam reaches it.

"Lagging" a cylinder is only a negative remedy; a means of prevention, not of cure. Cylinders waste heat inside as well as out, by radiation into the condenser, and the reduction of temperature due to expansion. Felt and boards cannot possibly restore this; and unless special means are provided for doing so, it is simply hopeless to expect economy. Fortunately, we are not confined to one arrangement. Four different systems of "cylinder heating," as we may term it, are more or less employed. These are: the use of a jacket, supplied with saturated or common steam; or with heated air; or with superheated steam; or the use of superheated steam, to work the engine, and of all the plans yet adopted, this seems to be almost beyond comparison the best. Not only does it provide a supply of pure gaseous steam, free from moisture, but it heats perforce every particle of metal with which it comes in contact, so that not the cylinder alone, but the lids and piston are raised directly to the same temperature. The surface presented by a large piston is very considerable, and it is, of course, beyond the power of any jacket to provide for the condensation which it may occasion if not kept up to the full initial heat of the steam in contact with it. But the principal advantage possessed by superheated steam, is the beautiful simplicity of all the arrangements connected with it. As now constructed, the necessary apparatus can be provided for about £2 per horse-power nominal. Experience proves that tubes last well, that leakages are rare, and that the expenses for repairs are small. When employed, as—like almost everything else—it should be in moderation, no danger exists of injury to valve faces or cylinders. A temperature of 300 to 360 deg. seems most suitable; and a heat such as this certainly cannot injure the most delicate surface met with in a valve or a piston. By its use, simple lagging may act as a very efficient substitute for the costly and heavy jacket. A little more time, and the experience which follows as a matter of course, will, we believe, place the superheater in a position which will entitle it to be considered indispensable to every steam-engine which pretends to even a moderate amount of economy.

THE LATE MR. JOSHUA FIELD.

With the deepest regret we record the death of Mr. Joshua Field, F.R.S., of the firm of Maudslay and Field, engineers. Mr. Field expired at his residence, Balham-hill, on the morning of the 11th instant; the immediate cause of his death being dropsy supervening on an attack of gout, his illness extending altogether over a period of four months. The deceased gentleman was in the 77th year of his age; and up to the commencement of the disease which has terminated so unfortunately, he possessed in the fullest degree all his powers of mind and body.

His death is too recent to enable us to give as yet as full a sketch of Mr. Field's life as we could wish. Of such men, data exist, and facts are known, which lie dormant, and almost forgotten, until time brings them to light.

The Institution of Civil Engineers owes its

existence to six young men—H. R. Palmer, Joshua Field, William Maudslay, J. Jones, C. Collinge, and James Ashwell—who founded it in 1817. Mr. Field was one of the earliest Vice-Presidents, holding that office until the 18th of January, 1848, when he was elected President, being the first mechanical engineer who filled the chair. The admirable manner in which he fulfilled his responsible duties is too well known to need comment.

To Mr. Field in connection with Mr. Maudslay, may be traced, in a great degree, the origin of ocean steam navigation. The engines put by these gentlemen on board the "Great Western" in March, 1838, were so completely successful that they long served as a model for other builders. On Sunday, the 8th of April, 1838, she started on her first voyage from Bristol with seven passengers, and 50 tons of goods, and reached New York on Monday the 23rd of April, thus accomplishing the 3,000 miles in 13 days 10 hours.

Mr. Field was not more respected for his talents as an engineer, than loved and esteemed for his amiable qualities and fine disposition. To know him as a man of science, was an honour; to be classed by him as a friend, was something, beside which even honour sank into insignifigance. His death has been a blow deeply felt by nearly every member of the profession.

Mr. Field was interred at Norwood Cemetery on Tuesday, the 18th inst. The funeral cortege consisted of nine mourning coaches, containing the relatives and more immediate friends of the deceased, and fourteen private carriages. At the cemetery gates were assembled a considerable number of workmen, principally elderly men, who have been engaged at the works for a long period.

The Institution of Civil Engineers was represented by Mr. J. Simpson (Past President), Mr. C. H. Gregory (Vice-President), Mr. Penn, Mr. Lloyd, Mr. Humphrys, Mr. Crampton, Mr. E. A. Cowper, Mr. Bryan Donkin, Mr. R. C. May, Mr. H. Maudslay, Mr. C. Sells, Mr. Joseph Freeman, Mr. Redman, Mr. Collins, Mr. P. W. Barlow, with Mr. James Forrest, the Secretary. There were also present Mr. Appold, Mr. Ravenhill, and many other engineers and men of science.

PRESERVATION OF IRON-PLATED AND OTHER SHIPS.

SIR,—Having noticed in several publications an account of the patent of Mr. Jean Pierre Jouvin for "preserving iron-plated and other vessels and metallic articles from oxidation and preventing ships bottoms from fouling," I think it advisable to address these few lines to you, not to discuss this important invention, but to lay before your readers a few facts which I have observed during the last few years, in the course of some researches which Mr. Richard Johnson and I have made on this most interesting subject.

In the year 1858, Mr. Johnson and I took plates of iron and covered 1-20th, 1-40th, 1-80th, and 1-100th of one surface with zinc plates, which we tied close to the iron plates, and then immersed them in soft and sea water. We examined these plates at the end of one, two, and three months, and finding that the zinc had exercised a very remarkable preservative effect on the iron, we brought the matter under the notice of Mr. Hewitson, shipbuilder on the Tees, who promised to institute a series of experiments in connection with his iron ships, to ascertain whether the results we had obtained in my laboratory would be confirmed on a practical scale, but this gentleman soon after fell ill, and consequently died. In the meantime, it occurred to us that the most practical mode of applying zinc for the preservation of iron ships would be to use galvanized iron, and we therefore instituted a series of experiments to ascertain the extent to which protection would be thus afforded.

Plates of iron 3 in. square were attached with great care to pieces of oak of the same extent of surface, and immersed in soft and sea water. Similar plates of galvanized iron were also similarly attached to pieces of oak and immersed in soft and sea water, and the following were the results observed after two months immersion—viz., from January 3 to March 5, 1862:—

		Loss by corrosion. 1st series of experiments. Grammes.		2nd series. Grammes.
Pieces of wood and iron.	In distilled water	1·230	...	1·230
	In salt water ...	2·400	...	2·380
Pieces of wood & galvanized iron.	In distilled water	0·100	...	0·125
	In salt water ...	0·095	...	0·090

We were anxious to know whether a prolongation of the experiment would continue to show the same comparison, and we therefore again immersed the iron plates in distilled and sea water until May, 1863, when the iron plates were again removed from the pieces of oak, carefully washed and dried, and weighed.

		Loss by corrosion. 1st series. Grammes.		2nd series. Grammes.
Pieces of wood and iron.	In distilled water	1·700	...	1·550
	In salt water ...	4·320	...	4·280
Pieces of wood & galvanized iron.	In distilled water	0·500	...	0·830
	In salt water ...	0·780	...	1·220

These results leave no doubt of the great protective power exercised by zinc against the corrosive action of water, and especially of sea water upon iron plates, I therefore think that all iron used in shipbuilding should be galvanized, and as this operation is now performed with such facility and so little expense, I cannot see any commercial objection to its general adoption. There is a further argument in the favour of this course in the fact that it is not the loss of iron only that is in question, important as that is, but there is also the wood which, especially in the case of oak, is rapidly deteriorated by the presence of oxide of iron, upon which the gallic and tannic acids of oak exercise a powerful action, and thus cause the wood to enter into a state of rapid decay or emaracausis, well known to shipbuilders.

Mr. Johnson and I also deemed it advisable to ascertain whether the zinc was liable to be removed from the surface of the iron by intense friction, and to decide this point we made the following experiments:—Large bolts, 1 ft. long and ½ in. in diameter, were driven into solid blocks of oak by a sledge hammer. The blocks were then opened, and the bolts were found to be not in the slightest degree uncoated. Another series of experiments was made, consisting of driving screws of the same diameter as the bolts into solid blocks of oak, and the same satisfactory results were observed.

I am, &c.,
F. CRACE CALVERT.

Manchester Royal Institution,
August 19, 1863.

NEW RESEARCHES UPON THE PRESERVATION OF BUILDING MATERIALS.

THE following Paper, by Mr. Fred. Kuhlman, is abstracted from the *Comptes Rendus de l'Academie des Sciences*:—

In my previous researches upon the hardening of stones, and the preservation of building materials, I had endeavoured to impregnate the porous stones, and the renderings in plaster or lime, with some mineral substance capable of combining with those bodies or those coatings. Amongst the chemical combinations that were unattackable, and susceptible of augmenting the hardness, the substance that seemed to me to merit the preference was the silicate of potash. But, because this agent is of general efficacy, it by no means follows that there may not be some circumstances in which its action is partly paralyzed by causes depending upon the nature of the materials, or of the conditions in which they may be placed at the moment of their application.

It is thus experience has shown that when the silicatization is applied to ancient constructions, its efficacy may be unsatisfactory, if there had previously existed in the walls a commencement of decay, developed under the influence of ammoniacal exhalations and constant damp. In such cases, the exterior coats of the walls and of the renderings, although hardened by the silicatization, are thrown off, and finish by detaching themselves by the formation of nitrous salts, and the decay continues to make progress. The expedient that I have found to answer best in those cases, for brick walls in particular, consists in removing entirely the coating and the joints of the work beneath in mortar, and, after having warmed the place by means of a moveable brazier, to cause them to absorb, by means of a brush, or by casting it upon the work to be protected, some pitch, arising from the distillation of coal, and applied as warm as possible. After cooling, the parts of the wall covered by the pitch can be recoated with a new rendering of plaster which will adhere perfectly well, and to which the silicatization will ensure the best conditions of durability and unalterability. Gas-tar has become of very general use in the towns of the north of France, to protect the basements of the houses from the effects of the external damp; but they have not yet been able to prevent the damp from rising in the interior by the effect of the capillarity. In my factory of chemical products I make a more general use of this tar still. I apply it hot upon all the exterior walls of the ovens, for decomposing salts, burning pyrites, concentrating sulphuric acid, &c., and I impregnate, by immersion in boiling tar, the tiles destined to the covering of roofs, particularly of those where there are any acid vapours produced.

In England, in the soda factories, where the hydrochloric acid is generally condensed in chimneys, or towers containing coke kept constantly wetted by a stream of water, the flagging which serves as a base to these towers, when it is of a porus nature, is immersed in hot tar before it is laid down. In other circumstances, the tar is used to colour tiles made of porous clay for general use.

If, in certain cases, the application of mineral waters to the preservation of walls would be difficult, it would not be impossible to employ organic matters less exposed to alterations than the resins and bitumens which the ancients had employed as the basis of the preparations for preserving the dead bodies, and which, by their unalterability, represent, in a similar manner to coal, a period of cessation in the decay of organic substances. The efficiency of coatings of a greasy or resinous nature, even though superficial, against the destructive action of the sea air, bringing with it sea water, was proved to me in the course of last summer, when I had occasion to examine the rapid progress of decay that was taking place in the porous sandstone of the chapel of St. Eugenie, on the borders of the sea, at Biarritz. The stones of this chapel, whose construction only dates from the year 1858, are profoundly corroded on all the points exposed to the wind, and I observed this peculiarity in the stones, which, before being put in place, were marked with oil colour, in black, that the parts covered with the colour were protected against alteration, so that the numbers now stand out in relief with great distinctness. The example of these figures in relief, in which the preservation of the stone was assured by the merely superficial application of the greasy or resinous matters, made me think that, in a

number of cases, the bitumens and resins might be made to play a very useful part in the preservation of buildings or sculptured decorations, if, instead of applying them to the surface, they were made to penetrate into the interior of the stones without decomposing their surface, as I had recommended should be done with the applications of mineral solutions.

I have made numerous essays to assure myself of the possibility of this penetration, by employing pitch derived from the distillation of coal-tar; it is a matter easily met with in commerce, and whose price (4 or 5 francs the 100 kilogrammes) is not high, and which serves now-a-days only for the manufacture of the small bricks made from the waste coal. I cause to be boiled in it, without any other pressure than that of the atmosphere, stones, carved or rough; bricks; objects made in clay, or simply dried in the open air which are able to form a pottery, without being burnt or varnished. These are boiled in vessels of cast or wrought iron, and I thus obtain a penetration of the pitch to a great depth, and with that a considerable degree of hardness and a perfect impermeability. These properties would render such materials essentially fitted for the construction of the foundations of houses, for the coverings of walls, for hydraulic works, and particularly to those exposed to the sea air. I have also formed with hot tar and some mineral substances in powder, pastes that are more or less fusible under the effects of heat, according as they may contain in their composition more or less tar, and which are susceptible of being moulded, with or without compression, into bricks, tiles, and into architectural ornaments of every kind. The matter whose incorporation has afforded the best results is, the oxide of iron resulting from the combustion of the pyrites, and which, when mixed with a quarter of its weight of tar, yields a paste which presents a hardness and a sonority that are very remarkable.

I have no necessity to dwell upon the frequent applications which such pastes as are impermeable would admit of, in building, in hydraulic works, especially in those washed by the sea, in which experience has shown that all cements, sooner or later, suffer disintegration. These materials, cemented together with melting tar or put together in the same manner that the constructions are formed of pounded clay (*en pise*), would make monoliths whose durability ought to be tried in our harbours.

The application of the silicious dissolutions upon plaster was that which yielded the most unsatisfactory results, because at the moment of contact there was an exchange of acid, and the production of gelatinous silica, which formed on the surface of the plaster an impermeable coating, which, in its turn, prevented the penetration of the silica to the centre of the mass. This does not occur with the calcareous stones, nor even with alabaster, in which the isolation of the silica, or its combination with the calcareous base, can take place more slowly. The silicious coatings produced upon plaster casts by the silicate of potash, present, moreover, the disadvantage, when they are produced by strong dissolutions, of cracking, and detaching in scales. The application of bituminous substances to preserving plaster then attracted the whole of my attention; and I am happy to be able to say that the chemical composition of the plaster, instead of being an obstacle, as in the case of the silication, to the hardening and impermeability of the body, on the contrary, tended to realize those results.

Indeed, not only does the melting tar penetrate the plaster by the aid of its great porosity, in the same manner in which it filters between the molecules of calcareous or friable sandstones, and thus destroys their permeability, but it also replaces the water of hydration in proportion as the latter escapes, when the objects that are cast in plaster are plunged into a bath of melted tar, whose temperature may be 600 deg. or 700 deg. Fahr., although the water of hydration escapes at 230 deg. or 248 deg. Fahr. The effect of the expulsion of the water of hydration under the circumstances, is easily understood; but that which it was hardly permitted to be hoped, and whose reaction is the most interesting in a scientific point of view is, that the objects thus cast in plaster should retain, without change of form, the outlines they had received in the moulds, and that the substitution of the tar for the water should be produced to great depths from the surface, when the ornaments, or the statues in plaster, remained a sufficiently long time in the bath of boiling tar. I obtained a very striking proof of this molecular substitution by the transformation of crystals of the natural sulphate of lime into a black shining mass, having the same crystalline form, and in which the water of crystallization had been changed, and the tar substituted. This constituted a singular instance of pseudo-morphism.

I have shown, in a work published upon ethers in 1841, that alcohol and sulphuric ether could form, like water, combinations which were crystallizable with certain acids, and anhydrous chlorides; but it is difficult to admit that the same thing should happen with plaster, for it is not only the tar, which, without altering the crystalline form of the gypsum, can substitute itself for the water of crystallization, but also of several other fatty or resinous matters; stearic acid is of this number. When, instead of melting the stearic acid in a sand-bath, as it is the custom to do, figures in plaster are moulded and impregnated superficially with this fatty acid, the bath of stearic acid is heated to 330 deg. or 400 deg. Fahr., it is easy to see that the water of hydration is expelled by a great bubbling that is produced by the passage of the water through the reacting liquid. It is a question, then, in my opinion, of a simple infiltration, determined by the vacuum that the water of filtration leaves in proportion to the elimination thereof, of an infiltration or intimate penetration, which takes place under such circumstances that the crystalline body should not cease to retain its form, and should acquire a great degree of hardness, which would not be the case when the water of crystallization is driven off by heat alone. It must be the case that this penetration, although the result of an action purely physical, must be very intimate; for washings with ether and benzine, repeated frequently, succeed in detaching the tar from the transformed crystals, however well pulverized they may be.

My manner of explaining the phenomenon observed seems the more admissible, because the number of the substances that can thus substitute themselves for water is considerable; but care must be taken, as the chemical action of all the substances upon the plaster is not the same, and they cannot be substituted indifferently to the dehydrized plaster at a temperature sufficient to drive off the water of crystallization, in the same manner as tar, stearic acid, oil, &c. In order to effect this substitution, it is necessary that the liquid in question should be able to *moisten* the plaster; for I have found it to be impossible to substitute sulphur, or mercury, for the water of crystallization.

I have already shown, in a work upon épigénisis, that there were numerous instances known in which crystallized bodies preserved their form, although they had lost one or more of their constituent principles: it is thus that I have converted the binoxide of manganese into the protoxide, and into an intermediate oxide; the oxide of copper, and the natural carbonate of lead, into copper and lead; the formiate of lead into the sulphate; all the while preserving to the new bodies the crystalline forms of the bodies which gave rise to them, with simple modifications in their porosity. It is in this way that I recently showed that crystals of acedote can be transformed into hausmannite without changing their form. However this may be, the substitution of tar for the water of hydration in moulded plaster, in gypseous alabaster, and in isolated crystals of the sulphate of lime, will fix the attention of geologists and crystallographers; and it is not impossible that a deeper study of this phenomenon may lead to some new observations that may throw some light upon the transformations to be met with in the history of the globe.

Under any circumstances, I hope that the interest the Academy may attach to these observations may be increased by the great resources that the facts I have recorded place at our disposal, for the increase of our houses in healthiness, and the improvement of their decoration. They will allow plaster moulded, and alabaster carved, to be used as ornaments sculptured, impervious to wet, and unattackable by the frost, and without any of the defects that now exclude plaster from the decoration of our houses and public buildings.

M. Payen cited, in confirmation of the observations of M. Kuhlmann, some facts that demonstrated the remarkable influence that thickened tar and fatty substances had upon the resistance and the impermeability of building materials. Some great examples had been given in this respect of immersing in melted tar, at about 400 deg. Fahr., some soft bricks that had been very successfully used in buildings destined to receive the chlorine gas when cemented with asphalte; some soft sandstones of Fontainbleau had been considerably hardened by this process; Champy, in 1813, had also preserved wood by injecting tar, in a similar manner, into the interstices and the channels of the wood.

On the occasion of the meeting of the Academy of Sciences on the 22nd of June, M. Frederick Kuhlmann read a second communication upon the same subject, in which he said that—

My opinion upon the part which I assigned to the tar, when it had penetrated the moulded plaster, and had been substituted for its water of hydration, has been confirmed by the following observations:—

When the water of hydration of the mineral matters can only be displaced at high temperatures, or when these matters are anhydrous, the tar infiltrates only into the fissures they present. I have proved this fact upon crystals of quartz, Iceland spar, rock salt, and upon other anhydrous minerals unattackable at the degree of temperature at which the operation has been effected. When the crystals are fibrous and manifestly porous, like those of an agonite, stalactite, &c., the penetration is more intimate. I ought to mention on this occasion that a topaz and a rock crystal, the fissures of which had been penetrated by the tar, presented, when looked at by transparency upon the thin edge of the coat of tar, a colour of sombre garnet, analogous to that which is presented by smoked quartz, and sufficiently near that which glass melted under the influence of smoke would do, and which disappears by the addition of a little saltpetre. It must, however, be admitted that it is possible that this colour may be owing to the properties of the tar, when it is in the state of a very thin layer.

Upon a specimen of opal, submitted for a certain time to the action of boiling tar, I have proved that, independently of the infiltration of the tar through the fissures, the little water this stone loses is proved by a tint of smoked blue, a tint exactly like that of a variety of the opal of Mexico, which is to be found in the Museum of the School of Mines. This colouration of the opal merits the attention of mineralogists, for it was the paste itself which had been uniformly impregnated with bitumen, and had assumed colours which might be useful to jewellers. It seems to me, also, to throw some light upon the bituminous substances that are sometimes found in rock crystals. Gun-flints yielded similar results. When the flint is embedded in a pudding-stone composed of silicious materials, the agglutinating material impregnates itself easily with the tar, whilst the colour of the flint changes slightly.

When certain marbles which are very open in their grain, and are marked with decided veins, are submitted to the action of melting tar or other resinous or fatty substances, such as the onyx, &c., phenomena precisely analogous occur. The modifications of colour, and the great consolidation that the marbles can derive from this operation, may be well employed in decoration.

It is not only the loss of the water of hydration that facilitates the penetration of the tar, or of the other resinous substances, into the mineral

matters, but it may be also the loss of the other constituent part of those matters. Thus, malachite, subjected to the action of boiling tar to a graduated temperature, is transformed—firstly, into a black matter, in which the copper rests as an oxide, and which retains the ribbed and filamentary structure of the malachite. But the malachite, as also the azurite, are reduced, and present themselves in the metallic state when the temperature attains 520 deg. or 570 deg. Fahr. Copper which has been arseniated becomes fused at the same temperature, and gives off the arsenic that is carried away by the vapours of the tar. The carbonate of lead is reduced at still lower temperatures. One of the most clear results that I have obtained has been in the tranformation, by means of the boiling tar, of the binoxide of manganese into the protoxide, without any change in the crystalline form of the binoxide, the tar having taken the place of the oxygen driven off for the benefit of the reducing body. The oxide of manganese, fater the reaction, does not give any trace of chlorine by its contact with hydrochloric acid.

In all these reactions, whether the tar displaces the water, or some other principle constitutin g the minerals, or may intervene by penetrating only the fissures of the matters, it is important that the temperature of the tar should be gradually raised, so as not to produce a disruption of the bodies submitted to its action. This precaution is particularly necessary, when it is required to submit to the melting tar articles in clay only dried in the air or in stoves, and which it may be desired to convert, in this manner, into impermeable pottery. When this heat is applied too briskly, the minerals and the clays are exposed to crack and to fly before the tar has had time to penetrate them.

By using the precaution that I have just indicated, I have obtained, with moulded clay and dried, pottery which, independently of the very great economy of its production, is recommendable on account of its impermeability, its hardness, and its great resistance to acids. The application of this pottery to drain-pipes, tiles (both roofing and flooring), and an infinity of other subjects that usually require economy of manufacture, seems to me susceptible of great extension, if I may judge by the results of the first trials made with a view to the success of these experiments, and which I have had the honour to submit to the Academy.

In a subsequent part of the evening some observations by M. Robinet were read, confirmatory of the remarks made by M. Kuhlmann, upon the preservative effects of the oil-colour inscriptions on the buildings of St. Eugenie, at Biarritz, and he cited other instances in proof of the great effects thus produced. — *The Journal of Gas Lighting.*

INSTITUTION OF CIVIL ENGINEERS.

SUBJECTS FOR PREMIUMS.

Session 1863-64.

The Council of the Institution of Civil Engineers invite communications on the subjects comprised in the following list, as well as upon others; such as 1, Authentic Details of the Progress of any Work in Civil Engineering, as far as absolutely executed (Smeaton's Account of the Eddystone Lighthouse may be taken as an example); 2, Descriptions of Engines and Machines of various kinds; or 3, Practical Essays on Subjects connected with Engineering, as, for instance, Metallurgy. For approved Original Communications on these, or other subjects, the Council will be prepared to award the Premiums arising out of special funds devoted for the purpose.

1. On the Decay of Materials in Tropical Climates, and the methods employed for arresting and preventing it.
2. On the Theory of Metal and Timber Arches.
3. On the Theory and details of Construction of Wrought Iron Girder Bridges.
4. On Land-slips, with the best means of preventing, or arresting them, with examples.
5. On the Pressure of Earth on Tunnels, and the conditions which limit its amount.
6. On the Theory and Practice of Artesian Well-boring, and of sinking large shafts, as now practised on the Continent.
7. On the results of contrivances for facilitating the Driving of Tunnels, or Drifts in Rock.
8. On the Principles to be observed in Laying-out lines of Railway through mountainous countries, with examples of their application in the Alps, the Pyrenees, the Indian Ghauts, the Rocky Mountains of America, and similar cases.
9. On the best means of preserving Railways in Alpine countries from interruptions from snow.
10. On the Results of recent experience in Iron Permanent Way.
11. On the Principles to be observed in the designing and arrangement of Terminal and other Railway Stations, Repairing Shops, Engine-sheds, &c., with reference to the traffic and the rolling stock.
12. On Railway Ferries, or the Transmission of Railway Trains entire across Rivers, Estuaries, &c.
13. On Locomotive Engines for ascending Steep Inclines, especially when in combination with sharp curves, on Railways.
14. On the Working of Locomotive Engines in Long Tunnels, with frequent stations.
15. On the Results of the Application of Giffard's Injector to the Boilers of Locomotive and other Engines.
16. On the Working Expenses of Railways, and the influence on these of the original design and construction.
17. On the Results of a series of observations on the Flow of Water from the Ground, in any large district; with accurately-recorded Rain-Gauge Registries, in the same locality, for a period of not less than twelve months.
18. On the Construction of Catch-water Reservoirs in Mountain Districts, for the supply of Towns, or for manufacturing purposes.
19. Accounts of existing Water-works; including the source of supply, a description of the different modes of collecting and filtering, the distribution throughout the streets of Towns, and the general practical results.
20. On the Best Means of Improving the Water Supply of the Metropolis.
21. On the Structural Details, and the Results in Use, of Apparatus for the Filtration of large volumes of water.
22. On the Drainage and Sewerage of large Towns; exemplified by accounts of the systems at present pursued, with regard to the level and position of the outfall, the form, dimensions, and material of the sewers, the prevention of emanations from them, the arrangements for connecting the house drains with the public sewers, the best means of limiting the contamination of rivers from the sewage discharged into them, and the disposal of the sewage, whether in a liquid form, as irrigation, or in a solid form, after deodorisation.
23. On the Results of the Employment of Steam Power on Canals, and of other measures for the Improvement of Canals as a means of conveyance for heavy traffic.
24. On Iron Paving, and a comparison of the Results attained by it, and by stone block paving, &c.
25. A History of any Fresh Water Channel, Tidal River, or Estuary—accompanied by plans and longitudinal and cross sections—including notices of any works which may have been executed upon it, and of the effects of the works; particularly of the relative value of Tidal and Fresh Water, and of the effect of Enclosures from the Tidal Area upon the general *regime*, of Sluicing where applied to the improvement of the entrance or the removal of a Bar, and of Groynes, or Parallel Training Walls. Also, of Dredging, with a description of the Machinery employed, and the cost of raising and depositing the material.
26. On the Results of a Series of Observations, illustrative of the modifications which the tidal wave undergoes in its passage up and down a river, or estuary.
27. On the Construction of Tidal, or other Dams, in a constant or variable depth of water; and on the use of wrought iron in their construction.
28. A History of any Harbour, or Dock, including the reasons for selecting the site, the mode of construction adopted, and the subsidiary works for the convenience of shipping, and for commercial purposes, with the cost, &c.
29. On Graving Docks and mechanical arrangements having a similar object, with the conditions determining their relative applicability in particular cases, as dependent on the rise of tide, the depth of water, and other circumstances.
30. On the arrangement and Construction of Floating Landing Stages, for passenger and other traffic, with existing examples.
31. On the different systems of Swing, Lifting, and other opening Bridges, with existing examples.
32. On the Construction of Lighthouses, their Machinery and Lighting Apparatus; with notices of the methods in use for distinguishing the different Lights.
33. On the Measure of Resistance to Steam Vessels at high Velocities.
34. On the Results of the use of Tubular Boilers, and of Steam at an increased pressure, with, or without superheating for Marine Engines, noticing particularly the difference in weight and in speed, in proportion to the Horse Power and the Tonnage.
35. On the relative advantages of the Principle of Expansion, as applied in the Single long-stroke Cylinder Engine, in the Double Cylinder Engine, and in the Three Cylinder Engine; and on the adaptation of the two latter to marine purposes.
36. On the Principles and Varieties of Construction of Blast Engines, with British and Foreign examples.
37. On the best description of Steam Fire Engines, and their power and efficiency, as compared with ordinary hand Fire Engines.
38. On the construction of, and the comparative duty performed by, modern Pumping Engines for raising Water, for the supply of Towns, or for the Drainage of Mines; noticing in the latter case, the depth and length of the underground workings, the height of the surface above the sea, the geological formation, the contiguity of streams, &c.
39. On Turbines and other Water Mo tors of a similar character; and their construction and performance, in comparison with Water-wheels.
40. On the present systems of Smelting Iron Ores; and on the conversion of cast iron into the malleable state, and of the manufacture of iron generally, comprising the distribution and management of Iron Works.
41. On the Manufacture of Iron for Rails and Wheel Tyres, having special reference to the increased capability of resisting lamination and abrasion; and accounts of the Machinery required for rolling heavy Rails, Shafts, and bars of Iron of large sectional area.
42. On the Manufacture of large masses of Iron for the purposes of Warfare, as Armour Plates, &c.
43. On the Construction of Rifled and Breech-loading Artillery; and on the Initial Velocity, Range, and Penetration of Rifled Projectiles, and the influence of Atmospheric Resistance.
44. On the Use of Steel Bars and Plates in Engine-work and Machinery, for Boilers and for Shipbuilding, as well as for Bridges.
45. On the Use of Steel in the Construction of Locomotive Engines, especially with reference to durability and the cost of repairs, in tyres and cranked axles, as compared with Iron of acknowledged good quality.
46. On the Bessemer and other processes of Steel-making; on the present state of the Steel Manufacture on the Continent of Europe; and on the employment of castings in Steel for Railway Wheels and other objects.
47. On the safe working strength of Iron and Steel, including the results of experiments on the Elastic Limit of long bars of Iron, and on the rate of decay by rusting, &c., and under prolonged strains.
48. On the Transmission of Electrical Signals through Submarine Cables.
49. On the present relative position of English and Continental Engineering Manufactories, especially with reference to their comparative positions in respect of the cost, and the character of the work produced.
50. Memoirs and accounts of the Works and Inventions of any of the following Engineers:—Sir Hugh Middleton, Arthur Woolf, Jonathan Hornblower, Richard Trevithick, William Murdoch (of Soho), Alexander Nimmo, and John Rennie.

Original Papers, Reports, or designs of these, or other eminent individuals, are particularly valuable for the Library of the Institution.

The competition for Premiums is not confined to Members, or Associates of the Institution, but is equally open to all persons, whether natives, or foreigners.

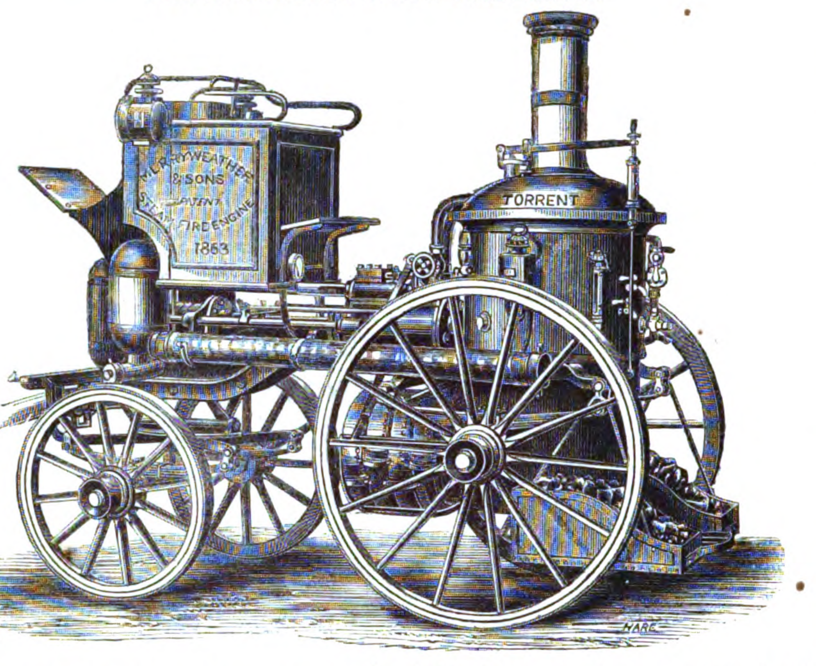
The Council will not consider themselves bound to award any Premium, should the Communication not be of adequate merit, but they will award more than one Premium, should there be several communications on the same subject deserving this mark of distinction.

The Communications must be forwarded, on or before the 1st of January, 1864, to the house of the Institution, No. 25, Great George-street, Westminster, S.W., where copies of this paper, and any further information may be obtained.

Charles Manby, Hon. Sec.
James Forrest, Sec.

25, Great George-street, Westminster, S.W.
August, 1863.

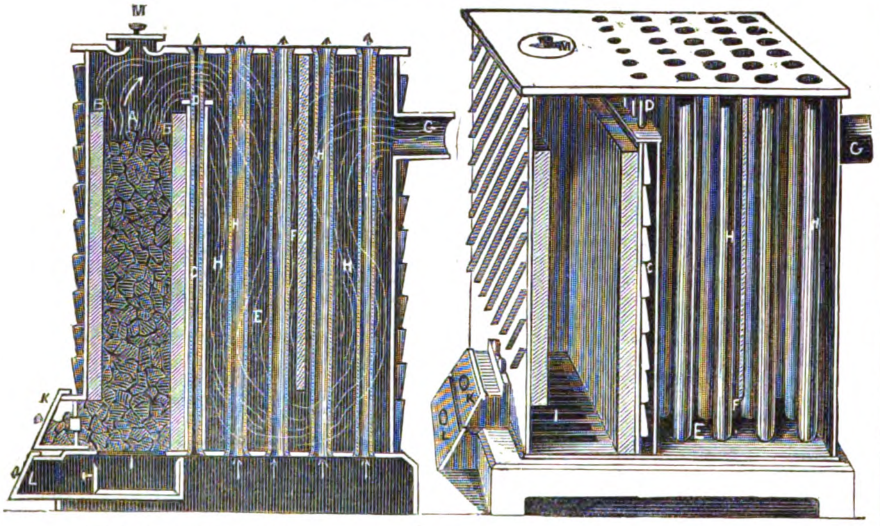
MERRYWEATHER'S STEAM FIRE-ENGINE.



MERRYWEATHER'S STEAM FIRE-ENGINE.

WE give above a perspective view of Messrs. Merryweather and Field's small steam fire-engine, which we have already fully described in the MECHANICS' MAGAZINE of July 27. The construction of the boiler is perhaps the most remarkable feature in the engines built by this firm; and to it in a great measure may be ascribed their success at the late trials. Both the large and small engines have the same boilers, and are externally very similar in appearance, the chief differences consisting in the arrangement of the cylinders, pumps, and valve gear.

RIDDELL'S STOVES.



RIDDELL'S STOVES.

THE following improvements in stoves have been patented by Mr. J. H. Riddell, of 155, Cheapside :—

This invention relates to stoves, usually called hot-air or slow-combustion stoves, and consists in an arrangement by which the heated or radiating surfaces of such stoves are so increased as to cause a large volume of air to be rapidly heated to a comparatively low temperature, instead of, as in former arrangements, heating a small volume of air to a high temperature, and which heated air can only be used after being mixed with a large volume of cold air. The invention is carried into effect by forming a fire-box of cast iron or other material, which may be lined with fire-bricks, and which fire-box is connected with one or more chambers, through which the heated products of combustion pass on their way to the chimney or vent; such chambers being fitted with metal or other tubes, either in a vertical or sloping position, through which tubes a current of air is constantly and rapidly flowing, and which air becomes heated in its passage and prepared for warming and ventilating churches, or large halls, or buildings.

Fig. 1 is a perspective view of the stove, with one side removed to show the internal arrangement; and fig. 2 is a vertical section, with the ventilating or respiratory tubes or pipes distinctly shown; the direction of the currents of warmed air being also indicated by arrows.

A is the fire-box; B, the fire-brick lining of the fire-box; C, a chamber formed at the back of the fire-box, through which air passes, and being heated as it ascends ultimately escapes through the pipes D. These pipes also act as a grating or check to prevent the fuel passing from the fire-box to the smoke chamber. E, E, is the smoke-box or chamber of the stove, which is divided by a curtain F, which descends to within a few inches of the base plate of the stove; G, the smoke nozzle, through which the smoke passes to the chimney; H, H, H, pipes of metal or earthenware, which pass through the smoke-box of the stove, and are open at the top and at the bottom, and fitted over corresponding openings in the top and bottom plates of the stove; I, the fire-bars; K, the upper mouthpiece, through which clinkers or cinders may be removed from the fire-box; L, the lower mouthpiece or regulating door, through which ashes are removed, and the air admitted to support combustion; M, the feed door or lid, through which the stove is supplied with fuel. This lid drops into a groove in the cover of the stove, which is filled with sand, and secures an air-tight joint, preventing the escape of any of the products of combustion, except to the chimney. When the stove is in action, the pipes H, H, H, become heated, and a current of cold air entering at their lower end passes through them, and as it becomes warmed by abstracting heat from the hot pipes it rises, and ultimately escapes from the upper orifice of the tube into the chamber to be warmed; and it may be observed, that the air does not become dried or over-heated in passing through these tubes, as it obeys a natural law, and the hotter the pipes become the more rapidly does the air pass through them and escape. The external radiating surface of the stove may also be increased by feathers or corrugations being cast upon it. There are thus two distinct currents passing through the stove—one consisting of smoke and the heated products of combustion passing from the fire-box A through the front chamber of the smoke-box E, then under the curtain F, up through the back chamber of the smoke-box E, and ultimately passing through the smoke-nozzle G to the chimney; the second current is composed of atmospheric air, which entering the respiratory or ventilating tubes at the bottom of the stove becomes warmed in its passage, and escapes through the top of the tubes into the chamber to be warmed.

COAL-CUTTING BY MACHINERY.

AN improved coal-cutting machine, invented by Messrs. Robert Ridley and Jones, has just been completed at Mr. Middleton's factory, in Loman-street, S.; and on Saturday last we took the opportunity of inspecting it at work, the cutting upon this occasion being made into a solid block of freestone. The size of the machine is about equal to that of a full-sized trunk, being about 3 ft. long, 1½ ft. wide, and 2 ft. high; it has flanged wheels, to run on the ordinary pit tramway, and weighs about ½ ton. Motion is given to it by a 6-inch cylinder high-pressure engine, the pick being connected with the end of the piston-rod; and by varying the mode of connecting, the blow may be given either right-handed or left-handed. There is an arrangement for regulating the depth and force of the blow, precisely similar to that used in the steam-hammer; and as the attendant has his hand constantly upon this regulator while the machine is at work, the precision obtained is fully equal to anything that could be obtained by hand labour. Indeed, the collier directing the machine must use precisely the same amount of judgment as if he were using an ordinary pick; the principal difference being that he is enabled to strike five blows with the machine for one blow with the hand.

With respect to the efficiency of machines upon which this is considered to be an improvement, we cannot do better than state the results recorded by Messrs Daglish and Wood, in their paper read before the North of England Institute of Engineers, as obtained in actual practice with Messrs. Donisthorpe, Firth, and Ridley's machine, at the West Ardsley Company's Balaclava Colliery, near Leeds. Working long wall, a kirving 35 yards long, and 37 in. deep, was made in 2 hours 45 minutes, including all stoppages; and in a subsequent experiment, a kirving 43½ yards long and 37½ in. deep was made in 2 hours 37 minutes, so that at the mean practicable working speed it would appear that a yard can be cut in about 4 minutes. A kirving at the depth mentioned would be made at three cuts; the first going in about 16 in., and the two subsequent cuts about 10 or 11 in. each. In these experiments the speed of the blows averaged about 40 per minute, but the machine just completed gave 15 in 10 seconds, so that it is probable 60 per minute could readily be given in the pit. As compressed air is used

instead of steam, the difficulties which have prevented the success of several of the machines which have been introduced do not exist, whilst the price of the machine being considerably under £100, and its liability to get out of order is very small, it cannot fail to be very generally adopted as soon as the amount of economy which it effects becomes generally known.—*Mining Journal.*

THE "SKIN RESISTANCE" OF SHIPS.

Although the laws of fluid friction would appear to have been well ascertained, the absolute frictional or skin resistance of ships is still the subject of much difference of opinion among men of science. Thus, it is admitted that fluid friction is independent of the pressure of the fluid upon the body moving through it, that it is directly as the wetted surface, and that it varies nearly as the square of the velocity. The friction of a body moving through a fluid is believed to be irrespective of the nature of the surface of the body, whether smooth or rough, a couche or stratum of liquid particles being carried along by the inequalities of a rough surface, the real fluid friction being, therefore, between separate and successive laminæ of fluid particles, rather than between the body itself and the fluid. We know, however, that a vessel, the bottom of which is covered by barnacles, and especially by long weeds, is greatly retarded in its passage through the water, but this fact is not absolutely irreconcileable with that of the uniformity of fluid friction upon all surfaces at the same speed. For, in the first place, shells, weeds, &c., actually enlarge a ship, giving it greater midship section, and greater extent of resisting surface. A great increase of resistance is occasioned also by the flowing of water between separate weeds and shells, and so, too, if a shell project, say, 3 in., and occasion head resistance due to such projection, and if a short distance aft of this another shell project to the same extent, and so on in a series, successive head resistances may be thus encountered equal perhaps to what would be due to a very large increase of the absolute midship section. Colonel Beaufoy, whose experiments, made about sixty years ago, on the resistance to floating bodies, were among the most complete of their kind ever made, concluded, however, that the friction of a smoothly painted board was one-eighth greater, after it had been well soaked in water, than when it was quite dry. With 50 square feet of smoothly painted board, which had lain for a long time in water, he found the friction to be 7¼ lb., at 4 knots an hour, and 25·04 lb. at 8 knots, a ratio rather less than that of the square of the speed. His estimate for a speed of 13 knots an hour was 1·2 lb. per square foot of the wetted surface of a vessel's bottom. He concluded that the friction on the sides of floating bodies was less at a few feet below the surface than at the surface. The friction of water flowing within pipes is now known to be twice that upon the same extent of surface of a body floating in open water, and a very large part of the power of a marine engine is absorbed in forcing a boat through a narrow channel say of but twice the width of the boat itself.

On a recent occasion this question of skin resistance was discussed by several of the first authorities in such matters. Mr. Scott Russell maintained that, at 26 statute miles an hour, the skin resistance would be 8 lb. per square foot of wetted surface, Mr. Hawksley believed it to be 1 9-16ths lb. per square foot at 10 miles an hour, or 15 ft. per second, and that, at high speeds, the resistance due to midship section virtually disappeared, while Mr. Phipps considered the skin resistance amounted to about 1 lb. per square foot at a speed of 12·2 miles per hour, or 17·9 ft. per second, which was not far from Colonel Beaufoy's conclusion. Mr. Russell's estimate, for a speed of 12 miles an hour, was 2 lb. per square foot.

It is certainly extraordinary when engineers of reputation speak of extinguishing the resistance due to midship section. The Holyhead boats, with 336 square feet of immersed midship section, force aside 17,000 tons of water per minute when running at 20 statute miles an hour, the water being forced at least 16 ft. aside on the average. The mere pressure of the water against the sides of the hull, however great it may be, does not, upon the first law of fluid friction, at all affect the result. So far as the mere inertia of the water is concerned, the boat acts like a wedge in overcoming it, and the effort is altogether independent of mere fluid friction. Who can suppose that if the 13,000 square feet of immersed surface of the Holyhead boats were represented by a thin vertical plate 650ft. long, and immersed 10ft., giving the same wetted surface, 4,750 indicated horse power would be required to drive it through the water at the rate of 20¼ statute miles an hour; this having been the actual power expended in driving the "Leinster" at that speed? This would give a skin resistance of about 6¾ lb. per square foot, a rate very nearly twice that which has been obtained by actual experiments at moderate velocities, the known rate of increase with velocity being not greater, at most, than as the square of the velocity.

Mr. Russell observed, during the discussion, that he did not believe that a speed of 20 miles an hour could be obtained with any boat less than 300 ft. long. Mr. Russell considers that any boat, intended to go at that speed, must have an entrance 168 ft. long, because that is the length of the wave of the first order moving at 20 miles an hour. This length of entrance is prescribed altogether irrespective of the width of the boat. An entrance of 168 ft. requires a run of 120 ft., so that, even without any length of straight middle body, 288 ft. would be required to make 20 miles an hour, no matter what the draught, the displacement, or the power! Yet, only the other day, the "Esploratore," an Italian *aviso*, with a copper-bottomed hull, built by Wigram, and with engines by Penn, attained a speed of 19·86 statute miles on trial, although the length between perpendiculars was but 240 ft. And although Mr. Russell, for some reason which we cannot understand, believes the skin resistance of an iron ship to be greater than that of a copper bottom (the former being supposed clean) it turned out that the whole resistance of the "Esploratore" was nearly 5¼ lb. for every square foot of immersed surface, say 8,400 square feet or thereabouts. On the Clyde, speeds of 20 miles an hour are made by boats only 200 ft. long; and Mr. Russell once, at the Royal Institution, admitted his belief that the American boats attained speeds of at least 22 miles an hour, although he made no reservation as to length. The "Daniel Drew," on which the Prince of Wales ascended the Hudson from West Point to Albany, has made 25 miles an hour against a slight current, and yet she is but about 250 ft. long. So much for the necessity of lengths of 300ft. for speeds of 20 miles an hour. Even if the whole resistance to the motion of a vessel were that arising from its adhesion to the water, and if the forcing aside of many thousand tons of water per minute, to a distance of 16ft. to 20ft. were to count for nothing, it is still evident that, if the friction of the skin were 6¾ lb. per square foot at 20 miles an hour, 2,400-horse power would drive 6,500 square ft. of surface through the water at that speed with the same ease as twice that power would carry twice the surface, and in the former case the whole surface might be in a boat only 150ft. long.

The notion that the whole resistance to the motion of a steam-vessel consists in fluid friction is, of course, in opposition to any presumption of advantage in the case of relatively long ships. If a ship 300 ft. long present 500 square feet of immersed surface, and have a displacement of 2,500 tons, then an increase of 100 ft. in her length amidships would not increase her midship section: it would increase her immersed surface by but about 6,500 square feet, and it would increase her displacement by 1,430 tons. It is evident that, in proportion to what a vessel so lengthened can carry, she will have much less resistance than before, and although the question of strength is one of great gravity and consequence in connection with long ships, it is not unlikely that, if it were satisfactorily disposed of, many steamship lines now supported by Government bounty might, by doubling the length of their ships, soon become self-supporting.

If the resistance to steamships consists only of skin resistance, they should be made circular or hemispherical, so as to present the least surface in proportion to their displacement. The punch-bowl pattern would be that having the least "skin resistance," and in that form our ships would be veritable "tubs." Colonel Beaufoy made an experiment *a propos* to this question of resistance. He provided a sphere and a cylinder, both of the same diameter, the latter having hemispherical ends. The midship section was the same in each case, the cylinder having the greater displacement and immersed surface. Yet at a given speed the sphere required 64·87 lb. to move it, while the cylinder required but 46·29 lb.

Mr. Russell has mentioned a phenomenon which, he confesses, is apparently inexplicable. On looking along a vessel when she is going fast, a ribbon of water will be seen sticking to her which is in a condition altogether different from that further from the ship. This ribbon, Mr. Russell alleges, does not alter its breadth with any change in the speed of the boat; it is, he says, exactly 3 in. wide for a boat 100 ft. long; 6 in. wide for a boat of 200 ft.; and 9 in. for a vessel of 300 ft. in length. It is, Mr. Russell thinks, in tearing this ribbon into shreds that the whole power of the engines of a steam-vessel is expended at high speeds. No doubt power is thus absorbed; but not one-half, we believe, of all that is required in driving the vessel.—*The Engineer.*

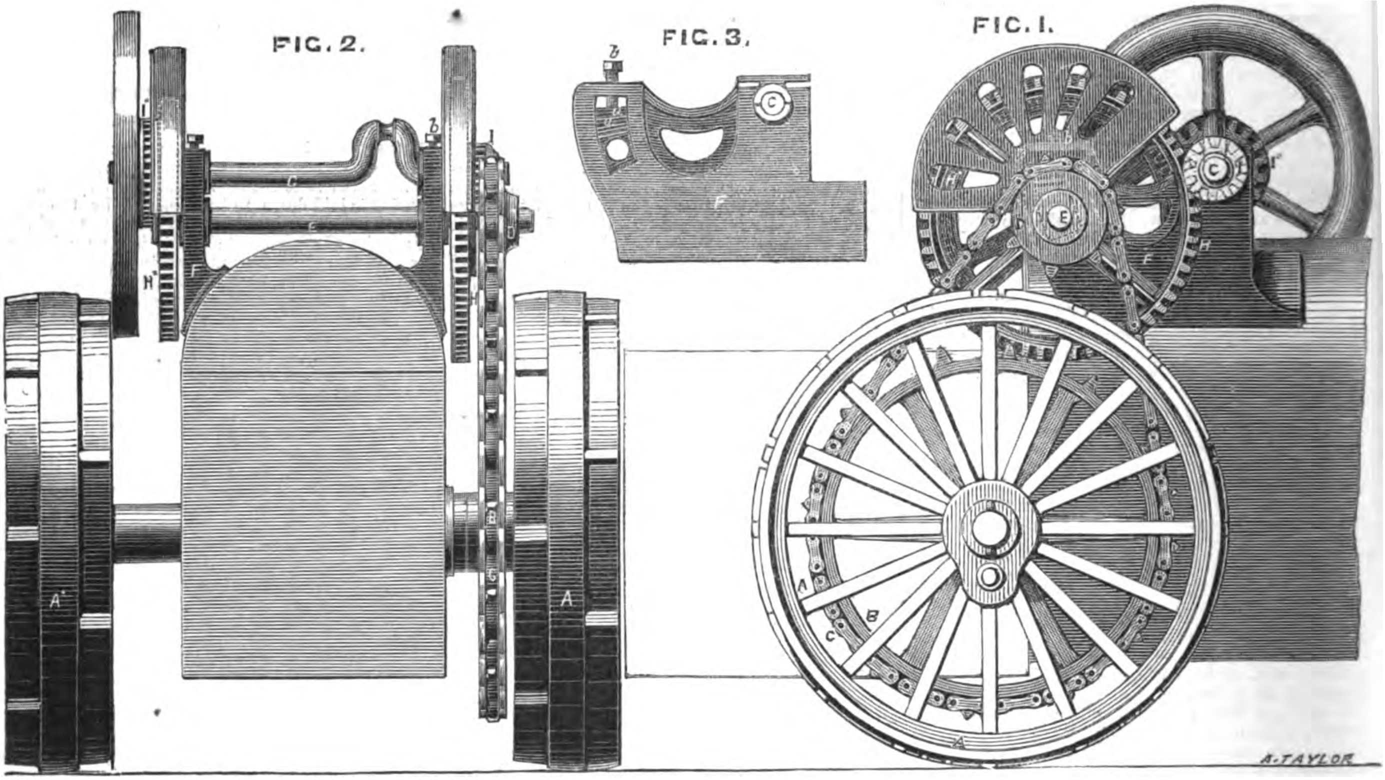
ECONOMICAL ADVANTAGES OF SYSTEM.

Persons who have noticed how work is carried on in many of our large machine-shops, cannot but wonder why it is that no established system and routine is laid down to be observed by the workmen. The advantages of such a plan are too obvious to require any comment; and it is, as we have remarked, incredible how many things are left to take care of themselves, that should have been regularly classified, and arranged with reference to the demands of the work. Let us take, for instance, the item of mandrils, as they are called here; or arbors, as they are better known in some other parts. These valuable, and indeed indispensable aids to machine work in too many instances have no more care or attention bestowed upon them than if they were scrap-iron. They are often made of iron, instead of steel, and are cut, hacked, battered, and ground in the centres, by careless workmen, until they are utterly useless. A good mandril costs too much money to be subjected to such usage, and this is but a little part of the evil; for where such bad practices prevail there are not likely to be good workmen, and no shop can create or maintain a reputation where such carelessness is permitted.

Such folly and wastefulness as this must and should receive the severest condemnation of every right-thinking person. System as applied to the use of mandrils, is not the only place where it might be adopted with good results. Let us take the matter of measurement, for instance. In too many workshops the only reliance for proper fitting work is placed on an old, illegible, greasy, shaky-jointed, smooth-ended, wooden two-foot rule; which is about as useful for measuring purposes as so many inches of a broomstick. With this valuable aid, the old-fogy workman gravely takes a pair of callipers, and turns up a shaft from it to the size of "four inches." Another individual bores out a wheel to "fit" it by *his* wooden rule; and the consequence is that, between them, about a sixteenth of an inch of daylight passes through the wheel when the shaft goes in, or else there is a similar quantity of iron to be forced through the bore of the wheel in excess of the proper measurement. These are not instances created for the sake of maintaining our assertion that some system is required, but are cases of too frequent occurrence, as every one familiar with the routine of a machine-shop can testify. What is true in the case of lathe-work is also correct as regards every other transaction where fitting depends upon actual measurement. The steel scale is an excellent substitute for the boxwood rule, and should be more generally employed by workmen; but none of these can compare in value with a set of standard gauges such as are used in the Novelty Iron Works in this city and other large and smaller machine works throughout the country. These guages, we believe, are made on the Whitworth standard, and for sizes of three inches are divided into sixteenths, while beyond that they are only graduated to eighths of an inch. These gauges can be made so that one end can be used in turning a shaft, while the other end is flattened like a fish-tail, and reduced to exactly the dimensions of the calliper ends. Thus a shaft turned by one end, and a hole bored so as to fit the opposite part, will cause both wheel and shaft to fit each other beautifully, without loss of time. This is so much better than the old-fashioned way of using callipers for the purpose, that the two are not to be spoken of in the same breath.

Every part of the machine business can be made the subject of a general and thorough reform. There are numbers of establishments in which wooden chucks, mandrils, bolts, washers, old files, stray hammers, lathe-tools, and every conceivable thing are scattered under the benches, lying on window-sills, and trodden under foot generally. What a spectacle of slovenliness and disorder such a place presents; and what a commentary it is upon the character of those in charge! The pecuniary loss sustained by such a state of things is enormous, and might be dispensed with by having everything in its proper place, and a regular and recognized system of procedure for all, so that work would not be spoiled by carelessness. One of the many advantages would also be soon apparent in encouraging a better class of workmen, and result in good to the whole trade generally.—*Scientific American.*

AVELING'S IMPROVEMENTS IN TRACTION ENGINES.



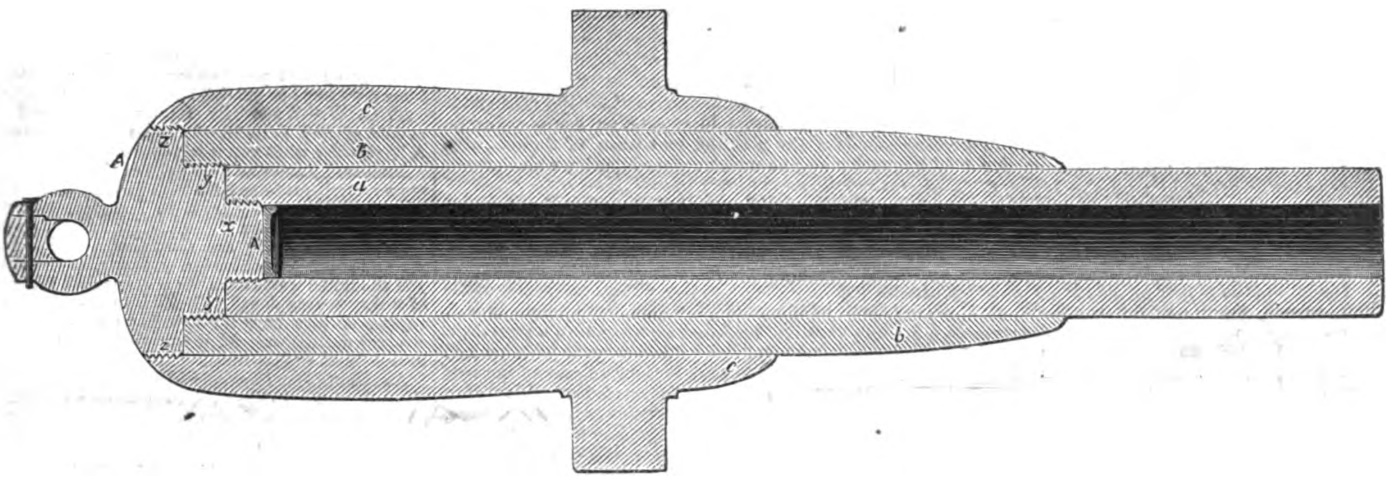
AVELING'S IMPROVEMENTS IN TRACTION ENGINES.

This invention relates to the application to traction engines of certain improvements in their details, with the view both of simplifying their construction and greatly enhancing their efficiency. It is well known that it is desirable to change the relative speeds of the carrying wheels and the crank shaft according to the varying levels or the character of the ground over which the engine is travelling. To effect this, many complex or cumbrous contrivances have been adopted which not only increased the weight but the cost of the engine. It is proposed to attain this end by the novel means shown in the accompanying drawing, in which fig. 1 is a side elevation, and fig. 2 an end view of so much of a traction engine as will serve to explain the nature of these improvements, the motion of the crank shaft being transmitted through an endless chain to the driven wheel. The carrying wheels A, A*, are made broad and cast with an annular rib in the middle of the periphery for running on hard ground and with lateral projections for ensuring a firm bite of the ground. On the boss of the wheel A, is keyed the ordinary chain wheel B, round which the chain C passes from a chain pinion D. This chain pinion is keyed on to a transverse shaft E, which is carried by brackets F that serve also to carry the crank shaft G. By thus mountiing these two shafts E and G on the same brackets, the use of additional fastenings for securing the brackets to the boiler are avoided, while at the same time, by the peculiar arrangement of the shafts, the distance between the chain pinion D and the crank shaft G is increased sufficiently to permit of the use of a larger diameter of pinion than usual, which is a matter of considerable importance as respects the maintenance of the gearing in efficient working order. Keyed to the opposite ends of the counter shaft E are spur wheels H, H*, having different numbers of teeth to suit two different speeds of driving, and into these wheels gear spur pinions I, I*, of varying diameter on the crank shaft. These pinions are free to slide on feathers on their shaft in order that either may be thrown into action at pleasure according to the driving speed required. They are by preference shifted by hand and kept in or out of gear as the case may be by the application of elastic clips composed of a strip of thin steel lined with leather. The clips are made to clasp the shaft and retain their position thereon. But when the pinions require to be shifted the clips are first taken off the shaft and the pinions being shifted laterally by hand the clips are again applied, but so as to bear against either side of the boss of the pinions. They will thus act like a fixed collar on the shaft, maintaining the pinions in the required lateral position. To allow of the slack of the chain C being taken up, the counter shaft bearings are set in segment slots in the brackets F, as shown best in the detached view, fig. 3. The segment slot, it will be seen is struck from the axis of the crank shaft G. The bearings of the counter shaft may be raised to any required height (within the limits of the slotted brackets) suitable for bringing the chain to tension by the insertion of blocks *a*, *a*, below the bearings, and they are then to be held firmly by a binding screw *b*. From this explanation it will be understood that when it is desired to reduce the speed transmitted to the driven wheel in order that the engine may be enabled to ascend an incline, it will only be necessary to throw the small pinion I into gear with its spur wheel H*. It will also be seen that when the greatest stress is put on the gearing, the strain will be directly through the gearing, and thus the counter shaft E will not suffer from torsion. When, however, the work is less severe the motion will be transmitted through the pinion and wheel I*, H*, and thence through the shaft E to the chain pinion D. In order to provide for a still further variation of speed it is only necessary to change the pinion D for one of less or more teeth, and two additional speeds will be thereby obtained.

IMPROVEMENTS IN LIGHTING HALLS, THEATRES, &c.

Mr. Enoch Bassett Keeling, architect, of Gray's Inn, has recently patented an improvement in lighting halls, theatres, &c. The invention is intended to be applied to the lighting of halls, theatres, and other buildings, and relates to the diffusion of intense light, and to the prevention of shadows. The inventor takes an electric light, a lime light, or other source of intense light, and places it in some elevated spot above the space to be lighted. Under or before, or part under and part before, this light he suspends or fits a plain white, tinted, or coloured curtain or screen, and again, in some instances, he places under or before a ceiling of glass or other transparent medium. By these means he removes the obstacles that have hitherto prevented the successful application of the electric, lime, or other intense lights to the lighting of the interiors of large rooms and public edifices, and that also have all but confined these sources of light to the position of mere scientific curiosities. It is well known that the chief obstacles have been the intense brilliancy of the lights, their unpleasant white or ghastly hue, and the dense black shadows thrown by them. The first, however, gives us so far a margin, that the medium of the curtain absolutely utilizes the objection by the sacrifice of brilliancy, but by the complete diffusion of the rays. The second obstacle is overcome by the tint or colour of the curtain or screen giving any hue most desirable to assimilate with any of the lights now usually employed, whether it be that of gas, of any description of oil lamp, of that of any wax or other candles. The relative use of the curtain or screen to the source of light is the same as that of the clouds to the sun. On a day of bright sunshine the radiating action of a centralized source of light casts shadows of a depth and darkness proportionate to the brilliancy and intensity of the light, whereas on a day without direct sunshine —that is, with a clouded sky—there is a pervading, an even, and a diffused light, and an almost total absence of shadow. The clouds in this instance cause a diffusion of the direct rays of the sun, which, in our case, is met by the employment of the curtain, blind, or screen combining imperviousness of glare with softness of light. The following are among some of the advantages derived from the employment of this invention in its application to public and private buildings: —Great excellence in the diffusion and softness of light, economy in cost, absence of all damage or detriment to the decorations of the apartment, and prevention of the risk of fire, as would be consequent upon the use of ordinary gas; and the power of assimilating the hue of light in the illu-

WHITWORTH AND HULSE'S IMPROVEMENTS IN ORDNANCE.



mination of the main body of a building with those used in remote portions, or in communicating apartments, that no difference would be perceptible, and the power of supplementing this light by the employment of gas in remote positions.

To illustrate the carrying of the invention into effect, we will suppose that it is required to light a hall. In a chamber constructed immediately above the ceiling are placed one or more lime lights, the number being proportional to the extent and cubical contents of the apartment and the proportion of light required, and at a distance below, only to be regulated by circumstances, are suspended across the chamber, by rings, or cords, or in any other most suitable manner, a curtain or screen, by preference of oiled silk, of a colour or tint to give the most desirable hue to the light. Mr. Keeling finds that the most pleasing light is produced by an oil silk curtain or screen of a light pink tint. The screen may either hang loosely or be drawn tightly across. The ceiling of the hall below the chamber he constructs in the ordinary manner of a ceiling, light, and of figured or ground glass. The intense rays of the light are, as before shown, diffused in passing through the curtain or screen, and the hall is pleasantly and effectually illuminated, and devoid of deep shadows. In some cases, for large halls and other apartments, it may be better to have two or more chambers above the ceiling, each with its own light or lights and curtains or screens arranged as before stated. The results attained would be a more shadowless and equal distribution of the light in the apartment below. Where the character or construction of the building would not allow of a chamber being constructed above the ceiling, the same end would be obtained by constructing the chamber below the ceiling in the form of an inverted dome in the centre or at one or both ends, or as, by preference, at each angle of the apartment; in the former case the curtain or screen would be under and around the light, as also would the glass screen, and in the latter cases under and before the light. The glass screens may, in certain instances, be entirely omitted.

WHITWORTH AND HULSE'S IMPROVEMENTS IN ORDNANCE.

The following improvements in guns have just been patented by Messrs. Joseph Whitworth and William Hulse, engineers, Manchester:—

This invention consists in the employment of an improved method of manufacturing ordnance made of what is now termed homogeneous metal, or mild steel, or steel iron, or other similar material.

The patentees cast an ingot with a hole through it, and afterwards hammer it between an angular-shaped anvil block and a hammer head of a similar or a flat shape. A mandril of a taper form is inserted through the hole cast in the ingot, and the operation of hammering or forging proceeds till the mandril becomes too hot, from its contact with the heated metal of the ingot; it is then withdrawn, and a cold mandril is inserted in the place of the heated one, and the hammer or forging is continued until it is made of the desired size and shape. If preferred, a hollow mandril may be used and cooled internally. The hammered tubular ingot is subsequently annealed. If necessary, the interior surface of the tubular ingot may be "converted" to the required depth.

For heavy guns, for ships and fortifications, constructed on what is termed the "built-up" system, the inventors make the inner tube from a tubular ingot, and strengthen the inner tube with cylinders made of homogeneous metal, as above described, and put on, by hydraulic pressure or other suitable means, in one or more series, as required. For closing the breech of these built-up guns, a breech is employed on which screws of two or more different diameters are cut. The screw with the smallest diameter takes into an interior screw in the breech end of the inner tube, and the screws of the larger diameters take at the same time into interior screws made in the second, or second and other series of hoops.

In the case of guns which do not require to be hooped the barrel is made from an ingot cast with a hole through, as above described, and bored and rifled after it has been forged and annealed.

In making the trunnions of ordnance, the patentees cast them with a hole through, employing homogeneous metal or strong pig iron or other suitable metal; the hole is afterwards bored, and for a portion of its length, or for its entire length, is screwed, the barrel or hoop of the gun (as the case may be) being screwed to receive it; or the trunnions may be made with, and form part of the outer hoop, as shown in the drawing.

The accompanying drawing represents the gun and the mode of constructing and attaching the breech by means of a triple screw; a screw with two different diameters is applied in the same way.

a, *a*, is the inner tube of a built-up gun with a first and second series of hoops *b*, *b*, and *c*, *c*; A, A, is the screw for closing the breech, having three series of different diameters, the smallest of which, *x*, takes into the screwed end of the inner tube *a*; the medium-sized screw *y* takes into the screwed end of the hoops *b*, *b*; and the largest size screw *z*, *z*, into the screwed end of the third series of hoops. By this arrangement the free and sudden expansion of the gun laterally by the action of the explosion is allowed, whilst the inner tube with its strengthening hoops are each made to take their own proper share of the end pressure arising from the explosion.

BAMFORD, BLOMLEY, TAYLOR, AND LETT'S IMPROVEMENTS IN LOOMS FOR WEAVING.

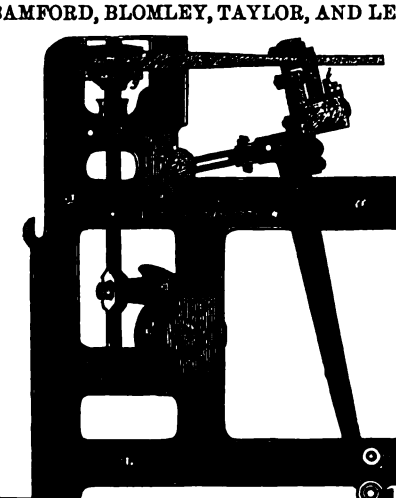


FIG. 1.

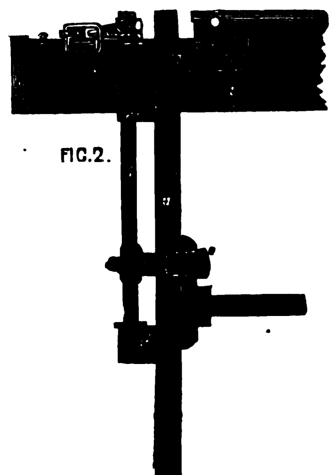


FIG. 2.

BAMFORD, BLOMLEY, TAYLOR, AND LETT'S IMPROVEMENTS IN LOOMS FOR WEAVING.

The following improvements in looms have been recently patented by Messrs. Abraham Bamford, Richard Blomley, R. Taylor, and J. Lett, all of Rochdale, Lancashire. The invention is described as follows:—

Hitherto in looms for weaving, it has been customary to connect the picking stick, when it has not moved with the lathe, to the picker by means of a strap, band, or chain.

Now the nature of this invention consists in connecting the picker to the picking stick without the intervention of the strap, band, or chain.

Fig. 1, in the accompanying drawing, repre-

sents an end elevation of a loom such as is used to weave calico, with this invention applied; and fig. 2 represents a front elevation of one end of the same.

a is the frame side of the loom; b, the driving or crank shaft; c, the tappet shaft, on which is mounted the tappet d, which works against the bowl e, and causes it to vibrate to and fro; this bowl is mounted on a stud e^1, which is screwed fast to the upright shaft, which is supported by the brackets f_1 and f^2; on the top of the shaft f is fastened a plate g, to which is fastened the picking stick; h is a spiral spring, which keeps the bowl e against the tappet d; i is the lathe; k, the shuttle-box bottom, which has a slot in it for the end of the picker to slide in; l is the shuttle-box front; m, the shuttle-box back, and n the spindle on which the picker slides; o, in fig. 2, is the shuttle-box end, it supports one end of the shuttle-box back, and one end of the spindle n: it is not shown in fig. 1, so that the picker and picking stick might be more distinctly seen. All the parts above enumerated are, as usually constructed, with the exception of the upright shaft which is made rather shorter, so as to bring the picking stick lower down; and the brackets f_1 and f_2, which are made rather longer, so as to throw the upright shaft rather farther from the loom side. p is the picker, which is made with a slot in the upper part of it, as shown in fig. 2, for the end of the picking stick to come through, so that when the picking stick moves, it pushes the picker backwards or forwards along the spindle n; by this means the straps, bands, or chains usually employed to connect the picking stick to the picker are dispensed with.

THE EFFECTS OF CONGELATION UPON WATER.

Dr. Robinet, a member of the Academy of Medicine, Paris, has published an account of experiments conducted by him to test the effects of congelation upon drinking-water. It is well known that the ice which is formed in the sea yields nothing but fresh water, all the salt having been eliminated by congelation. In the northern parts of Europe this property is turned to account for the extraction of salt from sea water; for a large sheet of the latter having been left to freeze, the ice is afterwards cut away, and the unfrozen water left below is so rich in salt as to require very little evaporation to yield it in a solid state. This property will also serve to analyze wine. Suppose it was required to determine the quantity of water fraudulently added to a certain wine; by exposing it to the action of artificial refrigeration, all the water would be alone, and the wine left in its purity. By a similar process, ships at sea, being short of water, might be supplied with this necessary article. We will suppose the temperature of sea water under the tropics to be 30 deg. centigrade. If a quantity be exposed in a vessel to the action of a mixture of sulphate of soda and hydrochloric acid, two very cheap commodities, the temperature of the water will fall to 10 deg. below freezing point. Let it then be exposed to a second mixture of the same kind, generally eight parts of sulphate to five of the acid, and the temperature may be lowered to 17 deg. below freezing point. Congealed water is then obtained free from salt, and may be used with impunity. Dr. Robinet has added a new fact to this theory by showing that the water of springs and rivers loses all its salts by congelation. These salts are chiefly those of lime and magnesia. The water subjected to experiment was that of the lakes of the Bois de Boulogne, the ice of which was found to be entirely free from the above-mentioned salts. Such, indeed, is the chemical purity of the water thus obtained, that it may in most instances be substituted for distilled water.

The first iron ship built in Liverpool by shipwrights, was launched on Wednesday from the ship yard of Messrs Potter and Co. She has been named the "Bedfordshire."

Legal Intelligence.

The following case was tried on Monday, at Gloucester, before Mr. Baron Bramwell and a special jury :—

BADHAM *v.* BALLARD AND BEASSEY.

This was an action brought for the negligence of the defendants in setting on fire some cattle sheds of the plaintiff, by reason of their using a steam-engine which emitted sparks, which caused the injury.

The plaintiff was the occupier of a farm at Beckford, near the Ashchurch and Evesham Railway, which the defendants were constructing, as contractors. On the 19th of May, at about 4 o'clock in the afternoon, some cattle sheds of the plaintiff, which were near a branch line used by the defendants to run to a gravel-pit and bring away ballast, were seen to be on fire. The fire was observed in four places on the roof of these sheds, which formed two sides of a square—one running alongside of the line of rails, and the other at right angles to them. The fire was on the outside and near the top of the roof of the shed which run parallel to the rails. The funnel of the defendants' engine, as it ran out of the ballast-pit, passed about 10 or 11 yards from the sheds, and the branch line being at this place, in a cutting, the top of the funnel would be some eight or ten feet below the roof of the sheds. A strong wind was blowing that afternoon in a direction across the rails and towards the sheds. An engine called the "Malvern" had left the ballast-pit with a load of trucks, and had passed by the sheds, according to plaintiff's witnesses, only five minutes before the fire was observed. Before the day in question sparks had been seen coming from the funnel of the "Malvern." The sheds were thatched, and were built of furze and gorse, and in a very short time were wholly consumed. The contents have been valued between the plaintiff and an insurance office at £340, and the plaintiff having been paid that sum, was suing as trustee for the office. For the defence, it was proved that tramps had been seen in the sheds in question, that persons had been seen smoking there, that workmen going to the ballast-pit were in the habit of passing along the top of the cutting between the sheds and the rail, that rye and stubble had been burnt on the plaintiff's farm about the time of the fire, and that other fires had occurred in the neighbourhood about that date. The "Malvern," on the day in question, was burning coal, and it was suggested on behalf of the plaintiff by a number of scientific witnesses that the escape of sparks from the funnel might have been prevented by the use of wire caps over the top of the funnel, or of "Venetian blinds" over the fire-holes, or of a brick arch over the fire-box. It was proved that the London and South-Western line had recently resumed the use of caps, which had been common ten years ago, and had fitted them to the majority of their engines. It was also proved that although the use of coal instead of coke had been recently resumed by railway companies, yet, inasmuch as coal was more likely to throw sparks than coke, some additional precaution became necessary. For the defendants, scientific evidence was also called, and it was proved that the "Malvern" was a very good engine, well constructed in all parts. Several engineers expressed an opinion that caps were useless, that good coal was not likely to throw more sparks than coke, and that, under all the circumstances of this line, and of the kind of work the "Malvern" was doing, it was highly improbable, not to say impossible, that any sparks could have been thrown from the funnel. It was also suggested that the "Malvern" was priming on this day, and that any sparks must therefore have been extinguished before they could escape. The advantage of caps was denied, as also of the other precautions suggested by the plantiff, and the defendants' witnesses were not aware that the use of such expedients had been lately resumed by the South-Western Railway.

The learned Judge left the question of negligence to the jury, who, on that point, found a verdict for the plaintiff.

TO CORRESPONDENTS.

Received.—T. D.—E. B.—G. F.—J. B. and Co. —C. Y.—E. F. and Co.

Spectrum.—The experiments you refer to have so far been very successful, but they have scarcely gone far enough yet to warrant full confidence in them; we hope to publish them at a future date.

T. C. W.—We really cannot recommend the maker of any particular species of machinery. Advertise for what you want.

Messrs. Dalton and Co.—Few, if any iron passenger carriages have been built in England. They have been frequently tried in America, but with very doubtful success.

Locomotive.—We are somewhat surprised by your question. If you are an engineer, as you state, you should be well aware that very many varieties of spring are employed. Besides india-rubber and volute, springs have been made in the form of a straight flat bar tapered at each end. The "Manhattan" had such springs.

An Engineer (Leeds).—We believe the largest steam-hammer in the world, is that at Creusot, in France. The wrought-iron head weighs nearly 12 tons; the fall 10ft.; and the weight of the anvil block, cast where it is, 86 tons.

T. M. M. (Whitechurch).—1. Yes. 2. Compressed cotton as a backing for armour-plates has been proposed long since.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

PETROLEUM GAS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—For the information of your readers and the public generally, and for my own satisfaction, and to testify to the able report of Mr. Bower, as published in your Magazine of the 16th August, I beg to state that the double-acting gas apparatus mentioned in that report—and capable of making, with equal facility, either coal gas, petroleum gas, oil gas, or wood gas—may be seen and tested at the General Gas Apparatus Depot, 218, Great Portland-street, W., where I attend daily from 10 to 3. The retort (which I invented and named the "Fitzmaurice retort," and which gives the great success) was illustrated and fully described in the Mechanics' Magazine in March, 1863. The good action and durability of the said retorts have been extraordinary—almost more than expected—as some fixed by me at the gasworks at Nutfield, Farningham, Linfield, the Earl of Shrewsbury's, Lord Hill's, and other places, upwards of three years ago, and now in action, testify, and from the engineers of which places I have the most encouraging and unsolicited reports.

I may add that my experience teaches me that "petroleum gas," or even the rosin-oil gas, or good cannel coal gas, may be depended on for lighting railway or other carriages with portable gas. The "Albert" vase for portable gas (invented and made by me, and now in possession of, and worked by Mr. Bower) is of copper bronzed, and in the shape of a pear inverted, fitted with ornamental handles, foot, high-pressure stop cock, pillar, and gas-burner, all moveable for table use. The processes are all described in a pamphlet called "Cottage Gasworks," published by Hebert, Cheapside.

I am, &c.,

James Copcutt.

Aylesbury and London,
Aug. 18, 1863.

Miscellanea.

The honour of knighthood is to be conferred on Mr. Goldsworthy Gurney, the inventor of a common road steam carriage, the Bude light, and also the successful ventilator of the two Houses of Parliament.

Messrs. A. Stephens and Son, have just launched from their new shipbuilding shed, at Kelvinhaugh, another of their wood and iron combination ships. The vessel is in question is a fine screw steamer of about 1,200 tons, is named the "Sea King," owned in London, and is, we understand, the first screw steamship built on the principle of iron frames and wood planking. She has been specially constructed for the China trade.

The Millwall Ironworks and Shipbuilding Company have received an order from the Admiralty to

construct within one month a target on the design of Mr. Reed, the recently-appointed Chief Constructor of the Navy. The price decided upon is £1,576, and the object sought by the Department of the Controller of the Navy is to test a principle by which it is proposed to secure in a reliable manner iron plates to the sides of the ships composing our iron-clad navy.

The Metropolitan Board of Works have accepted the offer of the Governors of St. Thomas's Hospital to purchase for £95,000 the ground on the southern embankment opposite the Houses of Parliament, as a site for the new hospital. The extent of the ground is 8½ acres.

Sunday, the 9th inst., was the hottest day, not only of the present year, but of this century, at Paris.

A public company is being formed for the embankment and reclamation of the Goodwin Sands into a valuable island, whereupon to build a new township, fortifications, docks, life-boat station, and wharfs; also to reclaim the land for agricultural purposes. By the proposed embankment, the whole of the channel between the Goodwin and the Break would become entirely clear. The sunken ships and treasures, it is thought, would pay all expenses. The land to be reclaimed will consist of about 20,000 acres.

A fresh application of electricity has just been made in an apparatus for voting presented to the Parliament of Vienna. Each of the deputies has before him, at his seat in the chamber, two knobs, one white and the other black, and the vote is given by pressing one of them. Two frames are placed by the side of the president, upon one of which the affirmative votes appear as white points on a black ground, and the negative upon the other, in black spots on a white ground. Each pressure of the deputy's hand on the knobs is marked by electricity upon one of the tablets, according to the vote which he wishes to give.

The annual report of the Royal Insurance Company, just issued, states that the fire premiums exceeded £300,000 in the last twelve months. The life premiums for 1862 show an advance of the preceding year of £18,952. From the report it appears, moreover, that the success of 1862 is likely to be even exceeded by that of the present year, as indicated by the seven months already elapsed.

We learn from the *Typographical Advertiser* that a gentleman, a large capitalist, and one of the most successful inventors of the day, has succeeded in chemically treating the pulp, during the process of manufacturing printing paper, in such a manner that when the paper is impressed upon the uninked types the chemical particles are crushed, and a perfect black impression is the result. The advantage sought to be obtained is the discarding of ink and rollers; and, by revolutionizing printing machinery, and printing from a continuous roll af paper, it is calculated that time occupied in impressing large quantities of paper will be nominal in comparison to the requirements of the present day. Cleanliness in the printing office would thus become proverbial, and the time now wasted in making and distributing the rollers obviated.

The following figures show the result of the Examinations of Science Schools and Classes of the Science and Art Department of the Committee of Council on Education:—The total number of individuals under instruction in 1863 was 3,811; and in 1862, 3,413. Of these 869 were in uncertificated classes last year, and about 700 this, making the increase in students in certificated classes between May, 1862, and May, 1863, 566. The total number of individual candidates who applied for examination in 1863 was 2,000; and in 1862, 1,708. The number of Papers worked in 1863 was 2,671, there being in practical, plain, and descriptive geometry, 288; in mechanical and machine drawing, 194; in building, construction, and naval architecture, 107; in theoretical mechanics, 35; in applied mechanics, 22; in acoustics, light, and heat, 121; in magnetism and electricity, 207: in inorganic chemistry, 679; in organic chemistry, 157; in geology, 129; in mineralogy, 46; in animal physiology, 343; in zoology, 41; in vegetable physiology and economic botany, 126; in systematic botany, 84; in mining, 29; in metallurgy, 63. In 1862 the total number of Papers was 1,943. The number of provincial local centres where examinations were held in 1863 was 64; and in 1862, 45. The number of metropolitan centres where examinations were held (including this Department) was, in 1863, 7; in 1862, 9. In 1863 the total number of successes were 2,127—viz., passes, 668; honourable mentions, 510; third grade prizes, 458; second grade prizes, 309; and first grade prizes, 182; and 544 failures. In 1862 the total number of successes was 1,480—viz., passes, 791; third grade prizes, 296; second grade prizes, 237; and first grade prizes, 156; and 463 failures.

The Constitutional Life Assurance and Loan Company appears to be in a prosperous condition. The total number of proposals including life, sickness and death, during the last year, was 4,333, assuring £56,975, and producing annually £3,603.

An unprecedented spectacle was witnessed by a large concourse of people on the Tyne on Saturday afternoon—viz., the launching of four large iron steamships at the same instant of time at a signal from a gun. The launches were from the building yards of Messrs. Palmer Brothers, at Jarrow and Howdon, which are nearly opposite each other; and the scene of four noble vessels rushing into the river at the same moment was such as has probably never been witnessed upon a commercial river before, and will be long remembered by the large crowd who witnessed it. The vessels were the "Latona," being the sixth of a line of steamships built by Messrs. Palmer for a company trading between London and Italy; the "John M'Intyre," a large screw collier, the property of Messrs. Cory and Co., of the Coal Exchange, London; the "No. 1," built for a Rotterdam firm, and, it is stated, intended to trade with Japan; and the "Europa," intended to be employed in the passenger and goods trade between Genoa and the Island of Sardinia. Their aggregate tonnage is about 4,300. To give some idea of the enormous development of the iron shipbuilding trade in the Tyne, it will suffice to state that this firm alone has 16,000 tons of iron shipping on the stocks, besides orders on hand nearly reaching 40,000 tons.

The iron-clad battery "Onondaga," says the *Scientific American*, was launched from the Continental Works, at Greenpoint, L. I., at half-past eight o'clock on the morning of the 29th ult. The "Onondaga" is known in naval circles as the "Quintard battery," so called from the gentleman who contracted for her, Mr. George W. Quintard, proprietor of the Morgan Iron Works. She is 230 ft. long, 52 ft. wide, and will have two turrets on the "Monitor" pattern, with the exception that a part of the turret is composed of heavy plates, instead of consecutive layers of thin ones, as in all the other "Monitors." The "Onondaga" is also peculiar in her side armour, which consists of heavy single plates 4½ in. thick, faced with timber 13 in. thick, which is in turn covered with an iron plate 1 in. thick. The deck is laid with plating amounting to 2 in. in thickness; and the rest of the vessel is very similar in general arrangement to others of the same class. The propelling power is two pair of horizontal back-acting engines, each driving a screw under the quarter. The "Onondaga" has no overhang forward and but little aft, and it is thought will prove a good sea-boat. The vessel was launched very successfully, going down the ways with great rapidity, and running far out into the river. The turrets are not yet placed on board, but are ready for erection. The rest of the machinery is all on board.

Cotton has been found in Cuba growing on a vine, which runs along and covers the ground. It is not very fine, but white and strong. As in the very hottest seasons there are heavy dews in Jamaica, it has been supposed that this kind of cotton is likely to succeed on the lands on which the tree and Sea Island cottons will not thrive. A very small quantity was tried in various parts of Jamaica, and some at the reformatory near Kingston. Through the kind attention of Earl Russell and the Foreign Office, the Jamaica Cotton Company are likely to obtain a considerable quantity of the seed.

A firm in Bridgewater, Massachusetts, are making a gun from wrought iron, which will weigh, when completed, about 17 tons. It is forged solid, in an octagonal form, with the cavity bored out 13 in. in diameter, and will be hooped with strong bands of iron put on by hydraulic pressure. The lathe on which the metal is being turned is one of the largest in the world.

The launch of the "Research," 4, 1,250 tons, iron-cased frigate, the first of the vessels constructed on Mr. Reed's plan, took place at Pembroke on Saturday evening. The ceremony of "christening" the ship was performed by Miss Kerr, daughter of Captain Lord F. H. Kerr, of the "Blenheim," 60, 400-horse-power, flag-ship at Pembroke. The vessel's mean draught of water after launching was found to be only 8 ft., or nearly a foot less than was calculated upon by the dockyard authorities. As she lay on the stocks there was but one opinion as to her ugliness, but, on getting afloat she was pronounced a rather stylish craft. She is intended to carry only four heavy guns, but will be entirely encased with from 4 to 4½-inch armour-plates. At present she has only four plates bolted to her sides, but the remainder are to be put on as speedily as possible, after which the "Research" will be sent to Devonport to be fitted for commission.

The new iron frigate "Bellerophon," is to be exactly 300 ft. in length, with a breadth of beam of 57 ft.; her draught of water will not, it is expected, exceed 26 ft. Orders have been received at the Chatham Dockyard for the construction of a target to be used in a series of experiments at Shoeburyness, to test the strength of the manner in which it is proposed to construct her sides. This target is now being put together at the Millwall Ironworks, and will shortly be ready to be operated upon. The target is to be constructed of 10-inch iron frames, placed about 2 ft. apart, on which will be first laid a covering of iron plates of about 2 in. in thickness. This will serve as the "skin" of the target, preparatory to a backing of 12-inch teak planking. The target will then be finally covered with iron armour-plates, of from 5 in. to 7 in. in thickness, but the exact thickness has not yet been decided upon. It is confidently expected that this construction will exceed in shot-resisting strength every other description of plating hitherto adopted in this country, and if the arrangement is found to succeed, the same mode of construction will be followed in building the "Bellerophon." It is, perhaps, the heaviest target yet made.

The *Army and Navy Gazette*, under the heading "Federal Facts and Un-English Fancies," says:—It strikes us that there is an unusual mode adopted by most of our public writers and journalists in dealing with the course of events in the American civil war. The question most important to us here in England is of a very military and political, not of a philosophical and metaphysical character. Whether the Americans lose or recover their liberties—whether they destroy or preserve State rights—whether they respect or annihilate the constitution, is for them a vital problem; but it does not so much practically concern us in Great Britain at the present moment, however curious and interesting for historical students it may be to study the words and acts of the model republicans. Great Britain is much more intimately concerned in the hard facts of the terrible war than in speculations as to greenbacks, habeas corpus, martial law, arbitrary arrests, taxation, and the like. She is most deeply interested in trying to discover whether the North is about to become a great military and naval power, with an overwhelming and triumphant army, and a fleet of great strength in their own waters. What use, then, is there in prophesying or speculating, in view of the facts before our eyes? These facts are, the retreat of Lee to the neighbourhood of Richmond, after a disastrous attempt on Pennsylvania, founded, it appears, on a miscalculation of the resoures of the Confederate Government in men, and the consequent reoccupation by the Federals of the Shenandoah Valley and Rappahannock; the complete possession of the Mississippi by the Federals, so that, contrary to our expectations, trade has commenced between St. Louis and New Orleans; their solid establishment in Tennessee and their less tranquil, but not less secure sway over Kentucky; their undisputed dominancy in the State of Mississippi itself; their approach to the frontiers of Georgia and Alabama; their grip of the seaboard tightening gradually; their strongholds established along the coast of North Carolina and South Carolina and Florida; their effectual severance of the States of Texas and Arkansas from the rest of the Confederacy; and their undisturbed hold of Missouri. Add to this catalogue the danger, very imminent to Charleston, Savannah, and Mobile, of destruction or capture by the Federal forces, and the increasing stringency of the Federal blockade—the vast losses of men not to be replaced on the part of the Confederacy, and the constant spread of Federal conquest; and it requires philosophy, metaphysics, historical parallels, and immense faith to believe that the South can continue her resistance to the North in the field, or preserve her States from the sway of Washington pro-consuls. On the other hand, there is said to be dissension in the North—there certainly have been riots in some Northern cities. The people will not enlist, and will not suffer conscription to be enforced. They will all be ruined by a financial crisis. The war is only carried on by "shoddy contractors"—very gallant must they be; and politicians, and clergy—very numerous and very valiant must they be, too. The country is so vast that it cannot be conquered or held. The North is not in earnest, or is tired of the war, or is corrupt, or, cowardly, and only fights with Irish and German hands which won't strike any longer—in fact, something is to take place which has certain

not yet taken place, and which is to undo the knot of facts accomplished which is just now pressing under the Southern ear. Let us continue—let us stick to our hard facts. In July, 1861, after the Battle of Bull Run, the boundary of the Southern Confederacy, as drawn by their bayonets in actual line, ran through the line of the Potomac, the centre of Kentucky, and the centre of Missouri. The Confederates held the Green River, had camps at Columbus, from which they threatened Cairo, and encamped higher up in Missouri, held St. Louis itself in alarm; they had possession of every seaport south of Baltimore; they had a blockade of the Potomac. Fort Pickens was the solitary standpost for the Federal flag in Southern seas. The line has now receded far indeed, and to it have marched up the advancing Federals. This has been accomplished, we are told, at the cost of an actual debt, on the 1st of July, 1863, of 1,097,274,356 dollars, or, in round numbers, of £219,600,000. Gold stands at 24 premium in New York; in Richmond it is 1,100 premium.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c.—*none.*
Boilers and Furnaces, 106, 125.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 137, 144.
Ships and Boats, including their fittings—*none.*
Cultivation of the Soil, including agricultural implements and machines, 120, 132.
Food and Beverages, including apparatus for preparing food for men and animals, 127, 135.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 107, 110, 112, 118, 121, 139, 143, 145.
Buildings and Building Materials, 124, 131.
Lighting, Heating, and Ventilating, 105, 113, 115, 129, 134, 146.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 101, 109, 111, 116, 140, 141, 142.
Metals, including apparatus for their manufacture, 114, 122, 123, 128, 130.
Chemistry and Photography, 102, 126, 133, 138.
Electrical Apparatus, 104.
Warfare, 136.
Letter-Press Printing, 117, 147.
Miscellaneous, 103, 108, 119.

101. J. B. Fenby. *A new or improved instrument or apparatus to be attached to pianofortes, organs, and other similar keyed musical instruments, for printing the score of any music performed on the said instruments.* Dated January 13, 1863.

This invention consists in certain mechanical arrangements actuated mainly by the agency of electricity, by the use of which the score of any music played upon the musical instrument to which the invention is attached is registered or printed. *Patent completed.*

102. T. Boyle. *An apparatus for multiplying indefinitely the reflections of all objects that are capable of being viewed in it, and to which the name of "The Comic Stereoscope" is given.* Dated January 13, 1863.

This invention consists externally of a tapering wooden box, narrow at the bottom and wide at the top or mouth, or *vice versa*, formed by sides inclining outwards or inwards, as the case may be, from the bottom at indefinite angles, according to circumstances. The circumstances on which the angles of the sides depend are, the curves of certain glasses to be fitted inside, and which may vary according to the effect intended to be produced. The interior of this frame is fitted with reflecting glasses varying in shape, and either flat or curved, or more or less in number, as the case may be, and which stand towards each other at suitable angles for producing the various effects stated. The effect generally stated is, that all objects viewed in this apparatus appear multiplied more or less in proportion to the number and power of the reflecting glasses used in its construction, and may be either enlarged, diminished, distorted, or presented in their natural forms according to the curves and shapes of the glasses. *Patent abandoned.*

103. D. and J. Tannahill. *Improvements in rivet-making machinery.* Dated January 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

104. W. Platts and J. Bailey. *Certain improvements in telegraphic cables.* Dated January 13, 1863.

This invention relates to a novel mode of protecting the wires employed in telegraphic communication, whereby the strain of any great length of cable is sustained by the covering or protection, instead of partially by the wire, as hitherto, and thus the continuity of the wire is preserved. The improvement consists in surrounding or enclosing the wires in a metallic tube or case formed in short lengths, every alternate length being formed like a ball at each end, the intermediate lengths being formed like a cup or socket, which are to enclose the balls, and all these lengths are to be made in halves (in the direction of their length) and bolted together or otherwise secured at their edges, so that, when they are so secured together with the balls in the sockets to form the joints, they will constitute a flexible tube, enclosing the wires, which will not gradually elongate by strain, as the twisted wire covering now employed. *Patent abandoned.*

105. J. T. Stroud. *Certain improvements in fixed and portable lights for domestic and other uses, applicable for burning gas and the mineral oils or spirits now so commonly used.* Dated January 13, 1863.

This invention consists—1, in the manner of constructing the parts of chandeliers, and brackets for receiving the burners and glass shades, and consists in supporting between the arms the part for holding the burner and glass shades, in contradistinction to fixing the supports for carrying the glass shades, chimneys, gallery, &c., on the ends of the arms, thereby cumbering the light with its obstruction, and consequent downward shadow. 2, in conveying the gas to a ring in which are circular or other formed openings or bearings (one mode for receiving the glass shades), thus producing the same result as last described, namely, the dispensing with all downward shadow by the removal of all metal work below the opening or bearing that supports the glass shade. 3, the patentee connects the ring for holding the aforesaid glasses to the body of the chandelier, or other suitable part of it, or by only inserting the cock or tap between them; by this method he dispenses with the usual arms, and thereby casts no shadow, and introduces an inexpensive mode of production. 4, in so constructing gas chandeliers that, while the principal lights are fixed or made to slide when desirable, the one centre light shall be fitted with an independent slide, so constructed as to admit of being considerably lowered from the other lights, thus possessing the quality to permit being down for lighting a table that may be placed beneath it, or other desirable purpose for which an increased or near light may be required. 5, in constructing a gas pendent light so that the same may be raised or lowered with weights as a counterpoise, and a water slide so constructed that the water shall not be subject to undue evaporation arising from its being placed immediately over the flame or light. 6, in the application to gas chandeliers and brackets of glasses or shades into a band, the lower part being inserted from the top; and, by preference, he supports it on two opposite radial pins that permit the shade to be pushed aside for the purpose of lighting, extinguishing, or regulating the flame. *Patent completed.*

106. C. H. Townsend and J. Young. *Improvements in compositions for preventing incrustation and corrosion in steam boilers and condensers.* Dated January 13, 1863.

These compositions may be applied in a state of powder or liquid, and they consist as follows:—1, Valonia, bark of the cork tree, and shumac; 2, Valonia and bark of the cork tree; 3, bark of the cork tree and shumac. The proportions of the above several compositions may be varied according to the water used in the boilers. *Patent completed.*

107. R. A. Brooman. *Improvements in machinery for lifting bobbins off spindles in spinning machines, and in lubricating spindles.* (A communication.) Dated January 13, 1863.

In spinning machines of the ordinary construction each bobbin has to be moved separately from its spindle, which entails a great loss of time where the operation has to be repeated many times a day. Now the object of the first part of this invention is to withdraw or raise a number of bobbins from the spindles simultaneously. There is a bar extending along the front of the machine, in which slots are formed to allow of its working up and down. The slotted bar is attached to a rack, in gear with a pinion, mounted on a shaft with a lever at one end connected to it. By moving the lever the pinion revolves, the rack and bar move in an upward direction, and the bar carries the bobbins with it, and lifts them up the spindles. The second part of the invention consists in fitting a box to the front of the machine for containing some lubricating material through which each spindle passes. *Patent completed.*

108. W. Southwood. *Improvements in machinery for manufacturing nails and brads.* Dated January 13, 1863.

This invention has reference to a previous patent dated May 13, 1862. The object of the present invention is that for the purpose of partly or completely forming that class of nails termed brads, the inventor employs a cutter or cutters of peculiar form, which will either cut, or cut, stamp, or press two brads at one time from slit bars or other forms of metal. The form of this cutter is varied as may be required, but its general features consist in forming a rebate upon the cutting edge, by which means both nails are cut by the under side of the cutter, one nail being stamped also by the under side of the cutter, whilst the second is stamped by the under side of the rebate. He can use with these cutters all or only a portion of the mechanism that is described in the specification of the former patent (May 13, 1862). *Patent abandoned.*

109. M. Tildesley. *Improvements in the manufacture of padlocks, and other locks and keys.* Dated January 13, 1863.

This invention consists—1, in coating all the parts of padlocks, except the spring, instead of making them of sheet or forged metals. 2, in a method of securing the shackle between the back and front plates to avoid employing the rivet pin. This the inventor effects by casting a sinking upon either side of the heel of the shackle, and a corresponding stud or rise upon the front and back plates, or a hole or a sinking in these plates with a stud or pin upon the heel of the shackle. 3, in forming a stop upon the cheek through which the bolt strikes, and against which stop the spoon of the shackle rests. 4, in such locks as usually employ a drill pin, he forms the key with a pointed end fitting a corresponding cup cast in the lock around which is a circular ward to receive the key. *Patent abandoned.*

110. C. E. Amos. *Improvements in machinery for the manufacture of paper.* Dated January 13, 1863.

In carrying out this invention, the knots and other extraneous matters which accumulate below the straining surface or knotter plates are drawn out or removed by means of a pump, or other analogous contrivance, and are conveyed into an ordinary knotter, which is to be used for the separation of such knots and extraneous matters from the fine pulp which may be drawn out or removed therewith. The fine pulp will then be allowed to flow back into the other or first knotter beneath the knotter plates, through which it will pass and be conducted into the paper machine while the knots will remain on the top of the knotter plate of the second or ordinary knotter, and may be readily removed therefrom by means of a skimmer or slice. By this arrangement of parts, there will be but little necessity for stopping the machinery in order to cleanse the knotters, and the work may therefore proceed uninterruptedly. *Patent completed.*

111. L. Lescuyer. *Improvements in india-rubber overshoes or goloshes.* Dated January 13, 1863.

This invention consists in the complete suppression of that which in an ordinary india-rubber overshoe or golosh constitutes the heel and waist, leaving the overshoe or golosh consisting only of the front half of the sole with its upper. The upper is made to come up very high, and terminates at the sides in two eyelets, each fitted with two double buttons, serving as pivots for two bands of elastic india-rubber fabric, which serve the same purpose as the straps of skates—that is to say, the said bands attach the overshoe or golosh securely to the foot, the bands being crossed one over the other behind the heels. The inventor also, according to this invention, lines or trims the improved india-rubber overshoes or golosh with fur, or the skins of animals with the hair on; and this part of the invention is also applicable to india-rubber overshoes or goloshes of other construction. *Patent abandoned.*

112. T. Butler. *Improvements in the manufacture of lace in twist lace machines.* Dated January 13, 1863.

For the purposes of this invention the warps or longitudinal threads of which a lace is to be composed are arranged in sets, in order that each set may be woven into a band or narrow weaving by means of two carriage threads, which is caused by the shogging of the way threads composing a set to pass alternately under and over the neighbouring warp threads, so as to produce tabby weavings. In addition to the longitudinal warp threads composing a set, and the two carriage threads which are employed to weft the same into a narrow tabby weaving, there is an additional way thread which is caused to be laid in a zig-zag direction to and fro across one surface of the narrow fabric produced as above explained, and such zig-zags of this warp are fastened to the surface of the weaving by causing the zig-zag warp thread to link or twist with the two carriage threads alternately. The warp threads composing the neighbouring bands or narrow weavings are at intervals (according to the pattern of lace desired to be produced) caused to be connected or to pass across each other, and in order to produce purls or loops on either edge of the band the zig-zags of the extra warps are caused to extend beyond the width of the bands or narrow weavings, and they are retained by threads which are afterwards withdrawn. *Patent abandoned.*

113. J. B. Rock. *Improvements in apparatus for saving life and property from fire and other danger in buildings and mines.* Dated January 13, 1863.

In constructing portable fire-escapes the patentee employs a tube constructed by preference of sheet iron, and mounted on a suitable wheeled carriage. At the upper and lower ends of the tube are rollers mounted on axes, and over these rollers endless chains pass, or a single chain may be employed, but this is not advisable. On the axis of the bottom roller cranked handles are fixed, by means of which the rollers can be made to rotate, and the chains to travel. These endless chains do not occupy the centre of the tube, but are placed on one side thereof, and at intervals apart there are brackets or steps hinged to the chains in such a manner that they fold down parallel to the chains when they are passing between the chains and the side of the tube adjacent to them, but stand out from the chains at right angles when passing on the other side of the chains. At the top of the tube is a small gallery or platform surrounded by a guard of wire work or other material. When the apparatus is employed for saving life or property from a burning building, the tube is set up against the wall of the building with its upper end near to a window. A man in charge of the apparatus then enters the lower end of the tube, and the cranked handles being turned by other persons he is, whilst standing on one of the hinged brackets or steps, wound up to the top of the tube; he lands on the gallery or platform at the top of the tube, and is then ready to receive from the window either persons or property, as the case may be. These he places on the brackets or steps of the endless chains, which are then by the persons at the crank handles below caused to travel, so as to lower the persons or property safely to the ground, the tube the meanwhile serving to prevent the possibility of their falling. *Patent abandoned.*

114. H. Bessemer. *Improvements in the manufacture and treatment of malleable iron and steel, and in furnaces, machinery, and apparatus employed in such manufacture.* Dated January 13, 1863.

This invention is described apart from the drawings. *Patent completed.*

115. J. Kidd. *Improvements in apparatus for measuring the quantity of gas supplied to single burners, and increasing its illuminating power.* Dated January 14, 1863.

The principal object of this invention is to determine the correct amount of gas consumed by public or private lights

in a given space of time, where a gas meter or registering apparatus is not in use, and the invention is carried out as follows:—Between the nib or burner and the gas regulator the inventor makes an adjustable aperture or hole for the passage of a certain quantity of gas; this hole is so arranged that it cannot be tampered with by the consumer when the apparatus is in operation; so that the gas passing through this hole at a regular pressure, no variation can occur in the quantity of gas passed through the apparatus in a given space of time. It is necessary in adapting regulators in connection with this adjusted aperture for measuring gas that this regulator should be so arranged as to give out the gas at a very low pressure, say from 3 to 5-10ths. By this means the regulator is always in action, even when the pressure is reduced to the lowest point, and the gas being consumed at this low pressure must necessarily pass through a nib or burner with a large opening, so as not to cause the check of pressure between the adjusted hole or aperture of the burner. The regulator for the purpose of this invention is formed with a valve and disc balanced or floated by the pressure of gas; the valve suspended to the centre of the disc opens and closes an aperture for the passage of the gas as the pressure varies. The disc may be made to float in mercury, or it may be composed of leather, or other suitable substance. *Patent abandoned.*

116. W. PIDDING. *Improvements in the soles and heels of boots and shoes, in stud nails, tips, and toe or other plates used therewith, and in placing and securing them.* Dated January 14, 1863.

In carrying out this invention, the inventor forms the inner soles and heels of boots and shoes of divisions of any non-elastic or non-pliable or pliable material or compound, such being perforated for the purpose of ventilation, or not perforated; and he places and fastens in any way between each such division other divisions of any elastic or pliable material or compound, to allow of their bending by the action of the foot when walking, and for the purpose of economy by using cheap materials or compounds in their manufacture. Or he forms the inner soles and heels of boots and shoes of perforated leather, or any elastic or other pliable material or compound. He forms some of the studs, nails, tips, and toe or other plates of stone, metal, wood, bark, porcelain, stone ware, glass, papier maché, cement, plaster of Paris, or any plastic material, concrete, shell, horn, bone, cork, leather, imitation leather, pith, resinous gum, or of any compound thereof. *Patent abandoned.*

117. J. A. SCHLUMBERGER. *An improved process for manufacturing colours for dyeing and printing.* (A communication.) Dated January 14, 1863.

In order to produce a true light blue which will appear blue at night as well as by day, the inventor takes a salt of rosaniline, such as hydrochlorate of rosaniline, and he mixes it with a suitable proportion, according to the shade required, of acetate of aniline, or an acetate of toluidine, or an acetate of any aniline homologues. In practice he mixes the rosaniline with three parts of aniline, and one and one-half part of acetic acid; he then neutralizes the mixture by adding thereto an equivalent proportion, say one part, of carbonate of soda, or soda, or any alkaline base which is able to decompose the acetate of aniline and produce a combined salt with the acetic acid used. The mixture is then heated to a temperature between 180 deg. and 210 deg. centigrade, as long as is requisite, in order to obtain the desired shade of blue, and until the mixture when looked at through a glass appears without any purplish tint. The product thus obtained is precipitated with strong muriatic acid, and is boiled up therein, when the blue colour will separate from the liquid, and will solidify it, so that it may be removed from the liquid by a skimmer. The colouring matter obtained may then be purified from the acid by boiling it several times in water, after which it may be pressed and dried. The colouring matter dissolved by the strong acid is precipitated with water, and will produce a blue of second quality, but no purplish or violet tint will appear. The colouring matters may then be dried, and will be ready for use if dissolved in alcohol or methylated spirit, and the shade produced is a blue which has no purplish tint by artificial light, but is a pure blue. *Patent completed.*

118. J. S. BUTLER. *Improvements in the manufacture of bobbin net made on bobbin net or twist lace machines.* Dated January 14, 1863.

The patentee claims—1, the manufacture of lace or bobbin net on twist lace machines, by causing three carriage or bobbin threads to work as weft threads, and twisting them together externally of the weavings; 2, the arrangement and combination of carriage threads and warp threads, or of carriage threads, warp threads, and gimp threads, in such manner as to produce net of any gauze less than the actual gauge of the machine on which it is produced. *Patent completed.*

119. G. T. BOUSFIELD. *Improvements in machinery for rolling, grinding, and cutting files.* (A communication.) Dated January 14, 1863.

This invention is not described apart from the drawings. *Patent completed.*

120. G. A. BIDDELL. *Improvements in machines for pulping turnips and other vegetable substances.* Dated January 14, 1863.

This invention relates to a class of machines known as root pulpers, having teeth or cutters projecting from the surface either of a disc, cone, or cylinder, which cut or tear the roots into mince or pulp. The improvements consist in so arranging the teeth or cutter of the machine that some of them shall project further from the surface of the disc or barrel to which they are attached than others, and so fixing them relatively to each other that those projecting the least shall not cut away the portions of the substances to be operated upon which have been left uncut by the longer teeth or cutters. By this improved arrangement of the teeth or cutters, the root or substance under operation is not allowed to rest idly upon the surface of the disc or barrel carrying the teeth or cutters, a defect in the action of all this class of machines as hitherto constructed. The teeth or cutters which project the furthest from the surface of the disc or barrel are made to pass between fixed projections, by which means the pulp is more evenly formed, and no large pieces of the substance under operation allowed to pass and mix with the pulp. The teeth or cutters are kept clean and prevented from clogging by means of a revolving brush or other suitable contrivance. *Patent completed.*

121. B. BURROWS. *Improvements in looms used in weaving narrow fabrics.* Dated January 14, 1863.

For the purposes of this invention, in order that shuttles of less length may be employed than have heretofore been necessary in weaving a given width of fabric, and so to admit of a greater number of fabrics being woven in a loom of a given width than has hitherto been possible. The patentee employs springs to each shuttle, which springs may either be fixed to the shuttle or to the batten, and each of such springs is arranged to act on that end of the shuttle which is still in the groove or slot in the batten, so as to counteract the tendency of the other end of the shuttle to drop as it passes across the space where the reed is situated, and before such other end of the shuttle has entered, and is supported in the groove or slot in the batten at the other side of the reed. In weaving narrow fabrics, it is common to employ two shuttles in making each fabric, and usually each shuttle has a reciprocating rack and a pinion to actuate it. The patentee employs only one reciprocating rack to actuate the pair of shuttles, and he employs therewith two toothed wheels to each pair of shuttles. The reciprocating rack gives motion to the two toothed wheels, and they give motion to two pinions, one on each side of the space in the batten where the reed is situated, and on the axes of such pinions there are two other pinions, which take into the racks of two shuttles. *Patent completed.*

122. J. LAWSON. *Improvements in apparatus for holding castings and other pieces while being planed or shaped.* Dated January 14, 1863.

This apparatus consists of a base plate, on which a turntable is mounted, and on the turn-table is a standard with its face perpendicular to the plane in which the turn-table rotates. The castings or pieces to be operated on are bolted to a slide which is capable of traversing the standard. The turn-table is rotated by means of a crank handle giving motion to spur wheels or gear, and the slide on the standard is caused to traverse, by preference, by a screw, which is also rotated by means of a crank handle acting with bevelled gear or otherwise. The apparatus may either form part of a planing or shaping machine, or may be separate therefrom, and with the pieces or castings upon it may be placed opposite the planing or shaping machine when work is to be done. The power which this apparatus gives of rotating the castings or pieces in front of the tool of the machine, and also of raising or lowering the castings or pieces, will allow of many different parts of the castings or pieces being brought within reach of the tool of the machine, without resetting the work; and, if desired, horizontal and vertical planing may be done at different parts of each casting or piece; and the apparatus ensures the truth of these several planings the one with the other. *Patent completed.*

123. E. MOREWOOD. *Improvements in the manufacture of coated metallic sheets or plates and pieces, and in apparatus to be used therein.* Dated January 14, 1863.

One part of this invention consists in making use of more than a pair of rollers working in or in contact with flux, such rollers being so arranged in relation to one another as to convey the sheets in the desired direction, and to accomplish one or both of the above-mentioned points by equalizing or reducing the coating metal on the surfaces of such sheets or plates whilst passing between them. The end of the sheet which slopes downwards on first entering is upward on leaving the flux. Another part of the invention consists in causing such sheets or suitable pieces, coated or in process of being coated, to travel between rollers working in contact with flux contained in two baths or vessels. The rollers and machinery in the two vessels are mechanically combined, so as to give the sheet a continued travel by the aid of machinery from the rollers of the first to and through the rollers connected with the second vessel. The object of the double bath is to enable the patentee to have the flux in two vessels at different temperatures, and to allow the sheet to lose a little of its heat in passing from the first bath to the second. Another part of the invention consists in arranging the screws and bearings of the pair of withdrawing rollers working at or near the surface of the flux, so as to enable the patentee readily to raise or depress such pair of rollers, so as to suit the varying thickness or size of the sheets which have to pass between them. *Patent completed.*

124. G. HOLT. *Improvements in apparatus for sweeping or cleaning chimneys, and also in apparatus for preventing chimneys from smoking.* Dated January 14, 1863.

For sweeping or cleaning chimneys, the inventor fixes a bar across the chimney at its lower end; this bar forms a step or support for an axis passing from top to bottom of the chimney. This axis is jointed at intervals, so that it may follow any bends there may be in the chimney, and it has hoops fixed on it at distances apart, which, resting against the sides of the chimney, keep the axis central, or nearly so. There are also fixed to the axis, at distances of a few inches apart, springs of thin metal sufficiently long to bear against the sides of the chimney, so that if the axis be caused to rotate, and at the same time to traverse slowly a short distance lengthwise of the chimney, the springs will come in contact with any part of the interior surface of the chimney, and will effectually remove any soot which may have lodged thereon. *Patent abandoned.*

125. T. WILKINSON. *Improvements in the manufacture of tubular steam boilers.* Dated January 14, 1863.

Heretofore, in constructing tubular steam boilers, the tube plate of the boiler which receives the tubes at the firebox end of the boiler has had holes made through it, through which the ends of the tubes have been passed. According to the present invention, the patentee forms around each hole in the plate a short tube, which projects out from the back of the plate, and on the exterior of each of these short tubes a screw thread is cut, in order that the ends of the tubes may be screwed on to them. The tube plate may be made of wrought iron or steel, or of copper or alloys of copper. *Patent completed.*

126. W. JOHNSON. *Improvements in the manufacture of chlorine and bleaching powder, carbonate of soda and soda-ash, and sulphate of iron.* (A communication.) Dated January 14, 1863.

This invention is not fully described apart from the drawings. *Patent completed.*

127. H. TURNER. *A process or mode of preventing and curing blight, decay, disease, and rot in potatoes, and other garden and farming produce.* Dated January 15, 1863.

This apparatus for preventing and curing blight, decay, disease, and rot in potatoes, consists of covers made of light framings of wood or metal, with calico or other suitable material stretched over them. The covers are made semi-circular, or of such a shape that, when the plants are covered, the atmosphere is excluded at the sides as well as from above. When the potato plants are covered in this manner, it is desirable to cause a current of air lengthwise under the cover, and this is produced by closing one end of the cover, and inserting a pipe or flue at the closed end, which pipe or flue is in connection with a heated flue or chimney, thereby rarefying the air, which produces the desired current under the cover; or the current of air may be produced in any other manner. These covers may be used at any time when the plants are liable to be injured by atmospheric influences. *Patent abandoned.*

128. W. HULSE and C. L. HAINES. *Improvements in machinery for the manufacture of taper metallic tubes.* Dated January 15, 1863.

This machinery is constructed as follows:—A taper mandril of the size of the taper tube to be made has a straight narrow slot made in its whole length, the said slot having the depth of about half an inch. The mandril fits in a bed which covers the lower half of the mandril, and a cover which partly covers the upper half of the mandril is capable of being fixed upon and removed from the before-mentioned bed. When the mandril is enclosed by the bed and cover, about three-fourths of the mandril are covered. The mandril is capable of being geared to driving mechanism, by which a slow rotary motion is given to it. In using the machinery, the taper mandril is placed in the bed, and the cover is fixed down. The edge of the sheet of metal to be made into a taper tube is introduced into the slot in the mandril, and the mandril is geared to the driving mechanism. As the mandril slowly rotates, it draws the sheet of metal between the mandril and the bed, and bends it into the form of an open-jointed taper tube. The cover serves to hold down the mandril, and also helps to bend the sheet of metal. After the mandril has made about two rotations, the figure of the tube is sufficiently perfect. The mandril being thrown out of gear with the driving machinery, the cover is removed, the cover lifted from the bed, and the taper tube drawn from off it. The taper tube may be finished by soldering in the ordinary manner. *Patent completed.*

129. E. HOWES. *Improvements in railway, ship, and other lamps.* Dated January 15, 1863.

This invention relates to railway, ship, and other lamps in which the flame is surrounded by or enclosed in a case to protect the said flame from wind and wet. The said case is so constructed that a sufficient quantity of air is admitted to the lamp for combustion, the burner and other parts of ship, railway, and other lamps being arranged as to avoid a shadow underneath the lamp. *Patent abandoned.*

130. T. C. BARRACLOUGH. *Improvements in apparatus for cutting metallic tubes or pipes, or pipes or tubes composed of other indurate substances.* (A communication.) Dated January 15, 1863.

This apparatus consists of two metallic jaws—by preference made of malleable or other elastic description of cast iron or steel—hinged together at one extremity, and so formed near the hinge or joint as to receive the pipe to be cut at right angles to the cutter employed. To these jaws at the further end to the hinge two steel or wrought iron rods are attached. The cutter which is made of steel slides vertically through one of the jaws, and its cutting force or pressure may be adjusted by means of a thumb screw above it. The pipe to be cut is placed in the hollow made for its reception, the two opposite ends of the rods brought nearly together, and secured by a link, links, or other substitute, the said jaws being thus caused to hold the pipe, and the cutter is tightened thereupon. If now the pipe be held firmly in a vice, and the apparatus turned several times round in a direction at right angles to the axis of the pipe, the cutter will penetrate the material and dissever the tube. If the metal or substance of which the tube is made be very thick, more pressure is to be applied gradually to the cutter by means of the screw until it is cut through. *Patent completed.*

131. T. C. BARRACLOUGH. *An improved alarum apparatus which may be employed in connection with locks or other fastenings.* (A communication.) Dated January 15, 1863.

This invention consists—1, in a novel arrangement and construction of mechanism designed to give alarm or signal by means of a bell which is struck by a hammer connected by mechanism with the latch and handle when opening or closing doors, drawers, tills, or other such means of enclosure or security, in conjunction with a disengaging gear. A second part of the invention consists in the application or combination of the said alaurm apparatus with locks or other similar fastenings, and in an arrangement of apparatus whereby the said alarum may be disconnected from the lock when its use is not required. This invention is not described apart from the drawings. *Patent completed.*

132. J. HARROP. *Improvements in the treatment of organic, fæcal, and urinous matters for the purpose of deodorizing the same, and in the preparation of a portable manure therefrom, and in the treatment of ashes and other refuse of combustion to be combined therewith ... for improveme...*

in machinery to be employed in the manufacture of the said manure. Dated January 15, 1863.

The patentee claims—1, The employment and use of chloride of sodium (muriate of soda or common salt), but more particularly that description which adheres to the bottoms and sides of the pans used in the manufacture thereof, and which is known by the makers as "pancake," or "salt pan scale," as a deodorizer or disinfectant in the manufacture of manure, either alone or combined with resin, pitch, coal gas tar, bitumen, asphalte, soot, wood, or peat charcoal, which aforesaid saline substances are to be applied during the accumulation of the fœcal and various matters to prevent decomposition and the generation of noxious effluvia therefrom, in contradistinction to the use of oleaginous matter in combination with common salt for the same purpose. 2, The application and use of hot or cold currents of air, either separately or combined with the draught and smoke of the furnace-flues, for the evaporation of fœcal and urinous matters. 3, The combination of parts forming the apparatus for evaporating, desiccating, or drying the excrementitious matters, as described. Lastly, the peculiar arrangement of the furnace and hot-air flues described, and the application of an exhaust pump, or of currents of hot or cold air, made as described. Also the novel arrangement and construction of a spiral rotating agitator, or a reciprocating perforated tubular one, of the form suitable to the shape of the boiler-pan or vessel employed, all as described and set forth. *Patent completed.*

133. G. GRAHAM and J. MCLEOD. *Improvements in apparatus to be used in Turkey-red dyeing.* Dated January 15, 1863.

This invention is not described apart from the drawings. *Patent completed.*

134. R. FERRIER. *Improvements in wet gas meters.* Dated January 15, 1863.

This invention relates to the construction of the wet gas meter in such a manner that the full supply of gas shall be maintained until the water in the meter from any cause falls below its proper level, when the continuous supply shall be effectually checked, and, if water be not supplied, shut off altogether. Also to an arrangement of securing the steady working of the fountain water, combined with a simple plan for regulating the meter to the standard measures, and the constructing of the meter and the waste water chamber so that no gas can be extracted unless first registered, and so that the water in the waste water chamber may be partly used to saturate the gas, and prevent it from drying up the water in the body of the meter. According to this invention a simple fluid syphon is applied on the entrance of the gas to the meter, so that no gas can pass unless the meter be filled to its proper level with water or other fluid, which also brings the syphon into action. *Patent completed.*

135. L. P. JOSSE. *An improved apparatus for cleaning wheat or other grain or seeds.* Dated January 15, 1863.

This apparatus consists of a shallow flat box, by preference of an equilateral triangular shape, formed of a bottom provided all round with a narrow rim (which box may, if required, be closed by a moveable lid, but which, by preference, is without such lid), so as to resemble a shallow equilateral triangular drawer, mounted either horizontally or in a slightly inclined or slanting position, with one of its corners pointing downward, on three or more feet of sheet metal, thin wood, or other suitable material of suitable flexibility for allowing the said box to receive a more or less rapid horizontal shaking, reciprocating, or to-and-fro motion in a direction parallel to that side of the box situated opposite the corner pointing downward. By this shaking or to-and-fro motion the grain and seeds, which from a hopper are allowed to fall into the said box, will be continually projected and thrown back from one to the other of the two remaining sides of the box, which will cause the chaff or lighter particles to rise towards the sides of the box situated opposite the above mentioned corner, whereas the grain or seeds or other heavier parts will be caused to advance towards this corner, and fall through an aperture provided in this part on to one or more perforated plates, screens, strainers, or sieves partaking of the motion of the box, in order to deprive the grain or seeds of any dust or foreign matters with which the same are contaminated; after this the cleansed grain or seeds fall into a proper receiver, whereas the chaff or lighter particles on the contrary rise on the top of the grain or seeds, and are caused to travel in an opposite direction to these latter, and take their exit from the box through a depression or aperture provided in that side of this latter situated opposite the above mentioned corner pointing downward, in case the box be situated in a slightly inclined or slanting position. The inside of the box is provided with one or more partitions and prismatic and other obstacles for conducting the grain or seeds, and for the better separation of the chaff or lighter particles from the same, whereas the dust or the heavy impurities—such for instance as small stones—are separated therefrom by the above mentioned strainers, sieves, screens, or perforated plates. *Patent completed.*

136. C. MURRELL. *Improvements in breech-loading firearms.* Dated January 15, 1863.

According to these improvements the inventor closes the breech-opening where the charge is introduced, by means of a short solid piece of metal about the size of the barrel at the breech, which is hinged thereto and folds up towards the muzzle in disclosing the bore. We cannot here quote the details of this invention. *Patent abandoned.*

137. J. P. BATH. *Improvements applicable to omnibuses, and other like carriages, to adapt them for use on rail or tram-roads, as well as common highways.* Dated January 15, 1863.

These improvements have for their object a simple arrangement whereby omnibuses and other like vehicles are rendered equally available for travelling upon rail or tramways or common high roads, and they consist in suspending by joints to the under side of the "fore carriage" two short pendulous arms, to the lower ends of which are attached axle-trees running parallel with the main axle-tree on the outside of these arms, and carrying thereon vertical revolving face plates, to the front of each of which is secured a disc, annular ring, or wheel, which, extending a short distance beyond the ordinary running wheels, acts as a flanch for keeping the bearing wheels on the rails. The inner ends of the axle-trees on the inside of the pendulous arms the inventor prefers, for the sake of strength, to bend upwards, and he attaches them to the centre of the main axle-tree by a suitable joint or joints. When the guides are in use, they are held in position by india-rubber or helical springs attached on each side to the lower end of the pendulous arms, and to the ends of cross beams or arms extending across the main axle-tree. When the carriage is required to run on the ordinary road, the guides are drawn up (by preference in a backward direction) by means of a bridle chain or cord and small windlass, or other mechanical equivalent, worked by the driver or other person. *Patent completed.*

138. C. H. G. WILLIAMS. *Improvements in the manufacture of colouring matters.* Dated January 15, 1863.

In order to produce a red colouring matter suitable for dyeing and printing, the inventor treats aniline or one of its homologues with the acetate of mercury. It is preferred that the aniline, or its homologue, should be employed in combination with acetic acid, as acetate of aniline (or of a homologue thereof), or it may be combined with hydrochloric or sulphuric acid, as a hydrochlorate or sulphate, or the aniline or its homologue may be employed in an uncombined state. The substances employed should be mixed together and heated until the colour is formed. *Patent abandoned.*

139. J. W. CHILD. *Improvements in means or apparatus employed in spinning and weaving.* Dated January 15, 1863.

Yarns to be used in weaving are spun upon tubes, which are usually of a cylindrical form, and such tubes have been formed of paper and other material. These improvements consist—1, in substituting for the cylindrical figure a polygonal figure, so that the outer surface of such tubes may be composed of a series of angles, and the patentee prefers that such angles be as sharp as possible by the surfaces between being hollowed. Such angles may be parallel or somewhat inclined across the axis of such tube, or slightly helical. Tubes thus formed will be found to fit more readily upon the wood or other internal tubes upon which they are placed during the spinning, as well as on the shuttle peg when in the shuttle, and the yarn as wound thereon will be more firmly held from slipping off bodily endwise, whilst it will also unwind or weave off more freely. He also applies to the ends of such tubes or receiver projecting rings of metal or other material to prevent the yarn in unwinding therefrom from catching on the raw edges or ends, as well as to enable such tubes to hold more yarn. He also forms tubes or receivers for yarn, when of a cylindrical or other form, with the outer surface thereof of differing diameter, by preference helical, and increasing in diameter towards one or both ends of them. He also forms such tubes with helical projections thereon. He also sometimes saturates or coats tubes when they are formed of paper with india rubber, or any other suitable matter adapted to resist the action of water or other liquid used to saturate the yarns thereon. These improvements relate, 2, to applying to the pins or pegs of the shuttles upon which such tubes are placed for weaving bands or rings of india rubber, leather, or other suitable elastic substance adapted to hold the tubes or receivers from slipping off. 3, The improvements relate to applying the washers upon which the flanges of the spools or spool tubes rest in spinning frames during the spinning, so that during the spinning, and as required, the amount of frictional surface exerted by such washers may be varied. *Patent completed.*

140. A. PRINCE. *Improvements in sewing machines.* Dated January 15, 1863.

This invention consists of certain mechanical arrangements whereby the fabric or material to be operated upon is propelled or moved along the needle plate by the motion of the needle bar, such motion being obtained by the action of screws or pins operating upon or against projections of metal, glass, or other hard substance, each presenting either an inclined plane or a curvilinear surface to the pins or screws, the projections being attached to and projecting from the front plate of the machine head, and set at the required angle. The invention further consists in the substitution of a needle plate of glass in lieu of metal for the purpose of allowing the operator to inspect the progress of the work, and also of an improved pressure foot. *Patent completed.*

141. W. E. NEWTON. *Improvements in microscopes.* (A communication.) Dated January 15, 1863.

This invention consists in a novel mode of constructing microscopes, whereby the observer is enabled to use the microscope in the same way as telescopes or kaleidoscopes are used. Instead of attaching the microscope to a stand which is placed on a table, and allowing the light to be thrown on the object by means of a glass or other mirror or reflector, the microscope may be used by holding it in the hands and looking through it with the object towards the light. *Patent completed.*

142. D. F. LEBLANC. *An improved level indicator or liquid gauge.* (A communication.) Dated January 15, 1863.

The glass tube indicators or gauges used to show the level of the liquid in steam boilers and other receivers placed under pressure have two principal defects—viz, their frequent breaking, which causes numerous accidents to happen, and the darkening of their sides, which renders their indications almost unperceivable. To obviate at once both of these defects the following combination is intended:—In experimenting with a rather thick-sided glass tube half-filled with water, the wide difference in refraction which exists between the full portion of it and the empty part thereof will be immediately noted or observed. On placing a screen with a circular hole of about two-thirds of the outside diameter of this tube behind that portion of the tube which is full of water, this circular hole will appear in the form of an ellipse, having its great or transverse axis perpendicular to the axis of the tube, whilst on the same screen being removed behind the empty portion of the tube, the ellipse assumes a rather lengthened form, having then its great or transverse axis parallel to that of the tube. It follows from this, first, that such a screen may be of avail to know—when no solution of continuity appears in the tube—whether this is quite empty or quite full; and, secondly, that however darkened its sides may be, unless they are altogether opaque, it will always be possible for any one to ascertain with its aid the presence or absence of the liquid inside. A metallic tube pierced from end to end with circular holes opposite to each other on two or three alternate diameters, and encasing the glass tube, may therefore become at once both a protection against breakages and their effects, and a means of more distinctly showing the height of the liquid inside. *Patent completed.*

143. R. A. BROOMAN. *Improvements in looms or machinery for the manufacture of lace and other fabrics.* (A communication.) Dated January 14, 1863.

These new points or features consist—1, In the employment of a chain mounted on fine bars, each of which is separately jacquarded as in the lever frame or machine, whereby the warp threads may be separately varied in the centre of the comb bars to the right and to the left at will, and also to a greater or lesser number of gates. 2, In the arrangement and employment of front and back comb bars, each separately jacquarded, capable of remaining fixed or of moving one or several times in the same or in contrary directions to the right or to the left, and that for a greater or lesser number of gates as required. 3, In fixing upon the back comb bars a number of pressers equal to the number of carriages, and each separately jacquarded, whereby all the carriages may be indiscriminately shifted. Besides the separate jacquarding of the pressers, the presser bar is also jacquarded in its general movement, so that it may either move or remain stationary. 4, In fixing on the front comb bars a number of pressors equal also to the number of carriages, but acting by one general movement, and allowing all the carriages without exception which may have been pressed forward to return upon the back bar. The bar carrying the front pressers is also jacquarded like the back bar—that is to say, it may be made to work or may be fixed at will. *Patent completed.*

144. J. KERR. *Certain improvements in retarding or stopping railway or other carriages.* Dated January 16, 1863.

This invention consists in connecting the ordinary buffer apparatus (consisting of buffer rods and draw springs) with the levers actuating the breaks, which may be effected by means of levers, links, or other equivalent connections, so that when the speed of the engine is slackened, the concussion or pressure of the buffers of the carriages behind shall compress the springs, transfer the impetus of the carriages to the breaks, and so stop the carriages. This may also be applied to carts or carriages on common roads, by connecting the straps, poles, or shafts by which the animal of draught retards the vehicle to breaks acting upon the wheels. *Patent abandoned.*

145. L. VERDURE. *Improved slubs or rovings (in flax, hemp, and other filamentous materials) produced by the slubbing frame and destined for fine spinning, as also for improved apparatus employed therein.* Dated January 16, 1863.

This invention consists in the employment of a rectangular steam chest provided with a steam-tight cover. In the said chest there are cross bars or trellises for supporting a number of bobbins covered with the slubs or rovings, and the bobbins are so placed that they do not touch each other. In the interior of the chest, near the bottom, there is a perforated pipe communicating by an outside pipe with a steam boiler; and at the lower part of the chest there is a pipe connected to a cistern or reservoir containing heated water or alkaline solution. When the bobbins are properly placed, and the chest covered, steam is admitted into the interior and kept in action so as to soak and heat the material on the bobbins, after which the steam cock is closed, and the water or solution is admitted to the interior to submerge the material for a time varying according to the nature and quality of the material, and when the water or solution is run off, and the bobbins removed, the slubs or rovings are prepared for fine spinning. By this process the gum resinous matters are removed from the material, thereby improving it in quality, and rendering it more easy to spin fine numbers, and at the same time diminishing the quantity of waste, and preventing the noxious effluvia caused by the fermentation which takes place in the ordinary troughs through which the slubs or or rovings pass from the creel to the drawing rollers of the spinning machine. *Patent completed.*

146. J. G. WINTER, and C. U. GRAY. *Improvements in vessels in which to cool and transport fatty or oleaginous matters, such as tallow, lard, palm oil, and the like.* Dated January 16, 1863.

Provisional protection has not been granted for this invention.

147. M. MOEGLEN. *Machinery for printing several colours in succession on the same surface.* Dated January 16, 1862.

This machinery consists of as many different rolls as there are to be colours in the patterns to be printed on the fabric. Each roll has engraved on it, or otherwise carries, the design it is to print; a separate colouring roller and apparatus for distributing the colour is provided for each of the printing rolls, as also a clothed roller for pressing the fabric against it. The fabric to be printed is first rolled upon a roller fitted at one end of the machine, it is drawn over a guide roller, then between the first printing roll and its pressing roller, whereby the design of such printing roll is printed say in blue; the fabric is then drawn between the second printing roll and its pressing roller, when, upon another part of the fabric not covered by the previous colour, the design upon the second printing roll is

...ated in a different colour, say red; and so on in succes... to receive the impression from as many printing rolls ...here are different colours in the pattern to be printed. ...tent abandoned.

...48. E. LOYSEL. *Improved apparatus for preserving valu... property, documents, and letters in cases of shipwreck,* ...ted January 16, 1863.

...n carrying out this invention, the inventor constructs ... safe or receptacle of iron, or other suitable strong ma...ial, and outside of this he places an outer casing, also of ...n, but much stronger than the inner one. A consider...e space is left between the two casings, and this space is ...ed, or partially filled, with blocks of some light wood, or ...her material, which will act as a stay between the two ...es, and will give great rigidity to the structure. In ...der to render these wooden or other blocks as light as ...sible, he first divides them in two, and hollows them ..., and then joins the parts together again, and secures ...em in their places between the casings. The safe may ... further protected externally by protecting hoops or rings, ...ich may be placed round the vessel, and will not only ...rengthen it, but will protect the casing from injury by ...mping on rocks when thrown overboard. *Patent aban...ned.*

149. W. SHORROCK. *Certain improvements in power ...ms for weaving.* Dated January 17, 1863.

This invention consists—1, in the novel and peculiar ar...ngement of apparatus for applying and regulating the ...wer or friction of the brake on the warp beam, whereby ...e inventor is enabled to keep a constant pressure upon such ...am during the operation of weaving; but should there be any ...perfection in the weaving, necessitating a reverse motion ... the warp beam, such reversing is accomplished without ...y pressure upon the beam by the said brake. A second ...rt of the invention consists in the employment and use ... bowls or pulleys secured below the healds and above the ...eadles, to which the healds and treadles are attached by ...eans of straps; such straps, when the treadles are in mo...on, partially warp or fold upon the above mentioned ...ulleys so causing by their connection with the healds a ...onstant rise and fall or shedding to such healds. These ...owls or pulleys act as intermediate carriers between the ...eadles and the healds, lessening the strain or weight upon ...e healds, thereby causing such healds to be more dura...le, also easier in their action upon the warps. *Patent ...bandoned.*

150. J. EDWARDS. *Improvements in the manufacture of ...uttons.* Dated January 17, 1863.

This invention is not described apart from the drawings. *...atent completed.*

151. J. LIGHTFOOT. *Improvements in printing and dye...ng textile fabrics and yarns.* Dated January 17, 1863.

This invention consists in the production of a black dye ...n textile fabrics or yarns by printing or staining them ...ith a salt or salts of aniline, or any analogous, homolo...ous, or isomeric compounds, mixed with certain metallic ...alts, or their oxides, as a mordant, as described. *Patent ...ompleted.*

152. J. ASHE. *Improvements in apparatus for pre...enting sea sickness.* Dated January 17, 1863.

These improvements in apparatus for the prevention of ...ea sickness are applicable both to suspended and balanced ...hairs, couches, and other supports for the person, and the ...bject thereof is to cause such chairs, couches, and other supports for the person to retain or remain in practically ...ne desired position, and counteract the rolling and pitch...ng motions of a ship at sea. *Patent completed.*

153. J. COMBE. *Improvements in machinery for spread...ng, drawing, and carding flax and other fibrous substances.* Dated January 17, 1863.

This invention consists in a new method for transposing fibres fed into the machine laterally, so that such fibres are presented endways in regular succession to the nip of a pair of rollers, which may either be delivering rollers, constituting a part of this machine, or may be the back rollers of a drawing frame, according to the manner in which the invention may be applied. We cannot here quote the details of the invention. *Patent completed.*

154. G. HAYCRAFT. *Improvements in powder flasks.* Dated January 17, 1863.

The patentee makes powder flasks with a hollow cylindrical screw stopper with a screw thread formed upon the outer side of it. This hollow cylindrical stopper closes the mouth of the flask, there being a corresponding female screw formed in the neck of the flask, and is closed at one end by a suitable head piece; it serves, when the flask is open, as a measure for the powder, it being made to contain one charge thereof. *Patent completed.*

155. G. T. BOUSFIELD. *Improvements in hot-air engines.* (A communication.) Dated January 17, 1863.

This invention is not described apart from the drawings. *Patent completed.*

156. W. E. NEWTON. *Improvements in the manufacture of buttons.* (A communication.) Dated January 17, 1863.

The special object of the present invention is to manufacture buttons in one piece, without soldering, by which means great strength is obtained, and the buttons are produced at a much lower cost and with greater expedition than by the ordinary means where the shank is soldered on. These results are obtained by the employment of special tools or apparatus which constitute the principle and essence of this invention, and which may be operated either by hand or by any suitable mechanical means, the different requisite operations being effected in succession, and in a determined order, for the complete manufacture of buttons in a single piece having a nearly spherical form. By means of the operations described in the specification of this invention, the buttons, of whatever metal they may be formed, are entirely finished without it being necessary to heat them, the metal being fashioned by successive operations in dies in a cold state, so that there is no risk of spoiling the material under operation, as is the case when it is heated by the soldering process. The invention cannot be described in detail without reference to the drawings. *Patent completed.*

157. E. SABEL. *Improvements in the manufacture of artificial stone.* (A communication.) Dated January 19, 1863.

The patentee claims the manufacture of an artificial stone by running molten cinder into large pits or moulds prepared for its reception (in the manner described in the specification), and in allowing the masses obtained to cool gradually. *Patent completed.*

158. C. NORTON. *Roughing horses.* Dated January 19, 1863.

In carrying out this invention the patentee takes a piece of iron of a fitting size and length, and turns it up at each end, proceeding first in a straight and then in a curved direction from the toe to the heel on one side, with holes at the toe and heal. The middle is riveted and bolted to another piece of iron in the centre, so as to be flexible and turned up at one end, with holes to screw in points of any size. Near their extremities, across the two pieces of iron, he fixes a bolt, flexible or otherwise, with a screw and nut at the end to widen or contract the before-mentioned two pieces of iron at the heel. *Patent abandoned.*

159. J. LAURIE. *Improvements in apparatus for churning milk and mixing liquid compounds.* Dated January 19, 1863.

In carrying out this invention, the inventor places a shaft in a horizontal position outside a vessel of any suitable shape or dimensions, and turns it by hand or power, and he places inside the said vessel any convenient number of dashers or beaters to revolve on bearings, motion being given to them by wheel gearing connected to the horizontal shaft, so that, when it is turned, the dashers revolve within each other, and in opposite directions, thus causing great agitation of the liquid or mixture, and, consequently, an economization of time and labour. *Patent abandoned.*

160. W. S. BROOKE. *Improvements in the manufacturé of insulators for electric telegraphs.* Dated January 19, 1863.

This invention refers to a previous patent, dated July 17, 1861, No. 1800. The inventor now substitutes for the ebonite cell mentioned in the specification of the former patent, a cell of hard and unvarnished papier maché, of the same shape as the ebonite cell, but thicker, so as to fit with strong friction into the iron cap, and to receive the iron pin also with strong friction. The several pieces are put together by lever pressure, the external cap being warmed so as to contract on cooling round the papier maché cell. The papier maché is thoroughly saturated with pure paraffine by being placed in a bath of this substance melted in a vacuum apparatus, by which all air is exhausted from the pores of the papier maché, and the liquid paraffine then forced in under a pressure of 100 lb. or more to an inch. He also employs plates of talc or layers of asbestos fibre within the iron cap, and between this and the papier maché cell, and also within this cell and between its internal surfaces and the central iron pin. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated April 22, 1863.

999. T. Settle, Bolton, spindle and flyer maker. Certain improvements in "flyers," to be employed in roving, slubbing, and spinning cotton and other fibrous substances.

Dated May 8, 1863.

1151. H. Schooling, 5, 6, and 7, North Side, Bethnal-green. Improvements in moulding or shaping lozenge paste or other plastic materials.

1154. J. H. Bailey, civil engineer, New York. An improved mechanical movement for producing an impelled current of air for lamps, and which may be used for other purposes. (A communication.)

Dated May 23, 1863.

1293. E. Barlow, Bolton, machine maker, J. Ashworth, jun., Turton, near Bolton, cotton spinner, J. Newhouse, Farnworth, near Bolton, manager, F. Hamilton, foreman, and W. Hope, carder, Bolton. Improvements in lap machines, for preparing cotton and other fibrous substances.

Dated June 3, 1863.

1385. E. A. Locke, Boston, United States. Improved means of securing identifying labels or tags to bales of fibrous material. (Partly a communication.)

Dated June 15, 1863.

1497. T. Petitjean, Geneva, Switzerland, chemist. Improvements in the manufacture of glass.

Dated June 25, 1863.

1603. W. Kirrage, 1, Victoria-street, City, surveyor. Using Apo elastikon hyphasma as a new and improved cloth for floors, roofs, walls, tanks, and other linings, being impervious to damp and of great strength and durability.

Dated July 2, 1863.

1649. W. Miller, 70, Upper Stamford-street, Blackfriars. An improved mode of evaporating through the combined agencies of heat and centrifugal force, and the machinery employed therein, more particularly applicable to saccharine solutions.

Dated July 6, 1863.

1673. J. Samuel, 26, Great George-street, Westminster, civil engineer. Improvements in the manufacture of gas for lighting and heating purposes, and in apparatus connected therewith.

1678. H. Caunter, Stornoway, Lewis, and county of Ross. An improved lubricating matter or composition.

Dated July 7, 1863.

1681. C. Schiele, 20, Milton-street, Manchester, engineer. Improvements in turbines.

1687. W. E. Gedge, 11, Wellington-street, Strand. Improvements in the construction of seats, chairs, sofas, lounges, and other similar articles of furniture. (A communication.)

Dated July 8, 1863.

1695. H. Armstrong, Whitby, York, alum manufacturer. Improvements in the manufacture of alum.

Dated July 9, 1863.

1713. W. V. Wilson, Jubilee-street, Mile-end, manufacturing chemist. Improvements in the manufacture of red colouring matter.

Dated July 11, 1863.

1735. A. Dixon, Harborne, Stafford, engineer, and J. Pumphrey, Birmingham, machinist. A new fastener or holder for flowers or other decorations to coats and articles of dress.

Dated July 13, 1863.

1743. R. D. Dwyer, Warrington, engineer. Improvements in the construction of letter copying presses.

1749. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in apparatus for suspending chandeliers, gaseliers, and other weights. (A communication.)

Dated July 14, 1863.

1765. J. L. Todd, Belfast, engineer and mechanic. Improvements applicable to the rollers of machines employed for spinning fibrous materials whilst in a wet state.

Dated July 16, 1863.

1785. C. Stokes, Leigh Sinton, Worcester, saddler. An improved expanding and contracting horse collar.

1787. J. Lamb, Kidderminster, machinist, and F. Tovey, auctioneer. Improvements in looms for weaving carpets.

Dated July 17, 1863.

1795. J. Darrieux, Candéran, France, merchant. Pounded glass powder for cleaning metals, and also for tooth powder.

Dated July 21, 1863.

1822. W. Clarke, Forest-road, Nottingham, lace manufacturer. Improvements in the manufacture of fabrics in twist lace machinery.

Dated July 22, 1863.

1833. J. Ronald, Liverpool, merchant. Improvements in apparatus for dressing or preparing for spinning hemp, flax, Manilla hemp, and other like fibrous material.

Dated July 23, 1863.

1840. W. Cole, carpenter and builder, 15, Wentworth-road, Bow-road. Improvements in apparatus for securing the safety of persons in window cleaning, or otherwise working outside of windows.

1841. A. T. Holden, Birmingham, manufacturer. Improvements in carriage and other springs.

1842. L. L. J. Fillion, 10, Rue de la Fidelité, Paris, glove maker. Improvements in apparatus for extinguishing chimney fires, and in preventing explosions.

1843. M. A. Soul, 3, Leadenhall-street. Improvements in expelling solid and liquid refuse matter from steam and sailing ships below the water line, applicable also for discharging cannon below water from ships and forts, and in part for charging gas retorts and iron furnaces, and for other similar useful purposes. (A communication.)

1845. W. and J. Garforth, Dukinfield, engineers. Certain improvements in preparing, beetling, or finishing textile fabrics, such as cotton, wool, linen, or other fibrous materials.

1847. W. Horton, Glasgow, gunmaker. Improvements in firearms.

1849. T. Perkins, Exchange-buildings, Hitchen, Hertfordshire, ironmonger. Improvements in horse rakes and hand rakes.

Dated July 24, 1863.

1851. W. L. Barnes, M.A., Norfolk. An improved method of breaking the speed of, and stopping, railway trains or other locomotive wheeled carriage or carriages, at the same time signalling to the driver, or for using the signal and break separately.

1853. T. Sturgeon, Belle Sauvage-yard. Improvements in chains.

Dated July 25, 1863.

1855. T. C. Bull and T. Morgan, Weobly, Hereford. An apparatus for collecting fruit from trees without injury.

1857. P. E. Gay, 5, Rue de Grenelle, St. Honore, Paris, contractor. Improvements in boring apparatus.

1858. J. Boyd, Glasgow, engineer. Improved mechanism for forming imitation selvages or longitudinal cords in weaving.

1859. F. Tolhausen, 17, Faubourg Montmartre, Paris. Improvements in the manufacture of gun barrels. (A communication.)

Dated July 27, 1863.

1861. J. W. Welch, Manchester, agent. Improvements in sizing and finishing fabrics, and in the machinery or apparatus employed therein.

1863. F. and L. Ford, Gloucester, manufacturers. Improvements in the manufacture of various articles with surfaces in imitation of different kinds of marbles or similar ornamental materials.

1867. J. Pain, Fort-street, Spitalfields, umbrella manufacturer. Improvement in the manufacture of umbrellas and parasols.

Dated July 28, 1863.

1873. D. Taylor, Bonchester-bridge, Roxburgh, joiner. Improvements in ventilating hay, corn, and other ricks, and in apparatus connected therewith.

1875. W. T. Smith, Dalston, engineer. An improved method of securing or tightening the cords of blinds and other rollers.

Dated July 29, 1863.

1877. P. H. Girardin, Paris. Improvements in lamps.

1879. G. Rickarby, 1, St. Giles's-road, and T. A. Barrett, 73, Observatory-street, Oxford. Improvements in window frames and sashes.

1881. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in cartridges. (A communication.)

Dated July 30, 1863.

1883. G. Inskeep, Madeley, engineer. An improved mill for grinding bones, grain, logwood, and such like substances.

1885. J. Boeddinghaus, Elberfeld, Prussia. Improvements in means or apparatus for the production of printed or particolored yarns.

1886. J. T. Stephens, Bridport, Dorset, gentleman, and C. Hoare, manager, Bridport. Improvements in ma-

chinery for the manufacture of yarns, threads, laid twine, and other cordage.

1888. W. Firth, Burley, near Leeds, merchant, and S. Firth, gentleman. Improvements in machinery and apparatus for working coal and other mines, and in apparatus for loading waggons or other vehicles.

1890. R. Hoe, Leadenhall-street, and H. J. Cole, New-street, Kennington-road, Surrey, packing case makers. Improvements in fastenings for packing cases.

1891. T. Apps, Lower Norwood, gentleman. Improvements in four-wheeled vehicles.

Dated July 31, 1863.

1892. W. and J. Graham, Burnley, machine makers. Certain improvements in looms for weaving.

1893. G. Sigl, Vienna, engineer. Improvements in the construction of force pumps.

1895. J. P. Culverwell, Dublin, gentleman. Improvements in railway lamps.

1896. J. B. Andreaux, 12, Rue Notre Dame de Nazareth, Paris, toy maker. Improvements in the application of steam to toy boats or other similar toys where steam can be employed as a motive power.

1898. J. F. Dickson, Bouverie-street, Fleet-street. Improvements in the manufacture of boots and shoes.

Dated August 1, 1863.

1901. W. Cotton, Loughborough, manufacturer. Improvements in the manufacture of looped fabrics, and in machinery or apparatus employed therein.

1902. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in dyeing mixed animal and vegetable fibres, whether in a raw or manufactured state. (A communication.)

1903. R. A. Brooman, 166, Fleet-street, patent agent. An improved warming pan. (A communication.)

1904. G. Taylor, Leeds, iron manufacturer. Improvements in shaping boiler and other plates, and in apparatus employed therein.

1905. J. Hoefler, Manchester, merchant. Certain improvements in the method of preparing and treating "Codilla fibre" and tow, to render them available as a substitute for cotton, or to be mixed therewith.

1906. J. Kirk, Burnley, overlooker of power looms. Certain improvements in looms for weaving.

1910. T. Fellowes and H. Hemfrey, Spalding. Improvements in apparatus for elevating straw and other agricultural produce.

1911. J. E. Vanner, Coleman-street. Improvements in the manufacture of umbrellas and parasols.

Dated August 3, 1863.

1912. E. A. Cowper, 35a, Great George-street, Westminster. Improvements in self-acting mules for spinning.

1913. J. W. P. Field, 233, High Holborn, gun maker. Improvements in the manufacture of sheaths or cases for staves or other similar weapons.

1916. H. Woods, Burton-upon-Trent, engineer. Improvements in the apparatus used for regulating the temperature during the process of fermentation in the "Union cask," "Tunning cask," or "Cleansing cask."

1917. J. Munro, 13, Melton-street, Euston-square. Improvements in apparatus for producing optical illusions.

Dated August 4, 1863.

1919. J. Abrahams, 9, Great Prescott-street, Goodman's-fields (East), watch manufacturer. Improvements in brakes for railway and other carriages.

1920. T. H. Baylis, 55, Mornington-road, Regent's-park, gentleman. Improvements in hawse pipes, mooring pipes, and deck chain pipes.

1921. G. Stevens, Malvern-cottages, Portland-place North, Clapham-road. Improvements in means or apparatus for effecting a regular supply of air or aeriform fluids for various purposes.

1922. S. Bury, Manchester, calenderer and finisher, and J. Price, engineer. Certain improvements in valves for steam engines.

1925. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in machinery or apparatus for moulding and casting hollow projectiles. (A communication.)

1926. E. Pace, Queen-street, manufacturer. Improvements in machinery for cutting splints for matches and for collecting the same.

1927. T. Pickersgill, Huddersfield, manufacturer of mill strapping for machinery. Improvements in machinery or apparatus for feeding wool, cotton, and other fibrous materials into machines for preparing the same for spinning.

Dated August 5, 1863.

1929. G. Clark, 30, Craven-street, Strand. Improvements in the construction and protection of ships, vessels, and floating batteries, and in the preparation and arrangement of materials for those purposes, some of such improvements being applicable to the construction and protection of land fortifications.

1931. W. Storer and J. Hancock, Nottingham, machinists. Improvements in electro-motive engines.

1932. C. Garton, Bristol, brewer, and T. Hill, sugar refiner. Improvements in evaporating and cooling.

1934. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved mode of, and apparatus for, producing stereotype plates. (A communication.)

Dated August 6, 1863.

1940. J. Tenwick, Albion Iron Foundry, Clarendon-street, Portsmouth, iron moulder. Improvements in self-acting valves and traps for sewers.

1942. W. Clark, 53, Chancery-lane, engineer. Improvements in ovens. (A communication.)

1946. J. Kirkham, Euston-road, civil engineer. Improved apparatus for generating heat for smelting and other purposes.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, August 18, 1863.

872. J. Swinburne and J. Stanley. Steam engines and generators.

874. A. C. Bamlett. Reaping and mowing machines.

888. W. E. Gedge. Apparatus for propelling and navigating small craft. (A communication.)

889. W. H. Mitchell. Barometer.

896. G. Spence. Preventing incrustation in steam-engine boilers.

897. A. Hett and F. W. Bassett. Preventing the fouling of ships' bottoms, and cleansing the same when fouled.

905. G. Colomb. Manufacturing blocks of wood of diversified shades and hues proper for veneering and other purposes.

908. S. Shelmerdine and J. Dransfield. Ornamentation by printing of felt hats.

916. J. Lockwood. Steam boiler and other furnaces.

917. D. Mylrea. Fire bars or furnace grids.

919. J. Farrar. Twisting or doubling yarns of wool or other fibrous substances.

920. W. Clark. Separating ores from their gangues, and and in apparatus for the same. (A communication.)

922. A. F. Maclure. Looms for weaving figured fabrics.

923. C. A. Collins. Apparatus for loading carts and waggons with hay, straw, and other similar products.

925. J. Gill. Printing machinery.

932. T. Mallinson and P. Williams. Opening, cleaning, carding, and grinding or sharpening cards used in preparing cotton and other fibrous materials.

936. W. and J. Keats. Boots, shoes, or other coverings for the feet.

937. J. Combe and J. H. Smalpage. Machines for winding cops, &c.

938. J. Keats and W. S. Clark. Sewing machines.

942. J. Smith. Furnaces and boilers for the generation of steam.

952. A. V. Newton. Blowing apparatus. (A communication.)

953. T. B. E. Fletcher. Collecting the solid portions of sewage.

957. C. Terrett, Preventing incrustation in steam boilers.

961. T. A. W. Clarke. Shuttle driver and apparatus for working the same.

971. B. J. Webber. Separating corn from the ears, and for combing straw.

972. C. W. and F. Siemens. Furnaces which are chiefly applicable to the smelting of iron.

995. W. C. Cambridge. Construction of harrows.

1010. W. E. Newton. Repairing worn-out files and rendering them again fit for use. (A communication.)

1064. W. Clark. Manufacture of paper. (A communication.)

1223. W. Clark. Repeating firearms. (A communication.)

1267. J. T. Markall. Machinery for working of wood.

1454. C. L. Van Tenac. Railway wooden sleepers. (A communication.)

1619. G. Davies. Cork-cutting machine. (A communication.)

1661. J. C. MacDonald and J. Calverley. Manufacture and application of printing apparatus.

1693. W. Basford. Generating and purifying gas made from coal and other bituminous substances.

1758. J., G. T., and F. R. Holmes. Threshing and dressing machines.

1761. R. Hornsby, jun., and J. E. Phillips. Reaping and mowing machines.

1800. G. F. Wilson and G. Payne. Soap.

1878. N. Thompson. Apparatus for stopping the bung-holes of casks and similar vessels; also tools or implements for fixing and removing such stopping apparatus.

1890. R. Hoe and J. Cole. Fastenings for packing-cases.

1906. J. Kirk. Looms for weaving.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 15, 1863.

430. J. Gimson.
431. E. Deville.
432. J. Durrant.
438. E. Strawson.
442. J. F. Spencer.
443. J. H. Bly.
448. G. T. Bousfield.
449. J. Puntis.
452. T. Markland and J. C. Dickinson.
459. H. B. Barlow.
461. W. Marsden.
462. C. Billingsley.
463. J. Bentley and H. Booth.
464. C. W. Siemens.
466. R. Bell.
1163. W. E. Gedge.
1167. W. Boaler.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1968. E. Wroughton and T. Holmes.
1976. W. Holms and J. Oldfield.
1979. W. Walton.
1980. C. Green and W. Asbury.
1991. R. and F. M. Mole.
2261. W. E. Newton.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1913. W. Tranter.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending August 15, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
3095	1 10	9	1 0	19	0 10	28	0 8	37	3 4	49	1 10
1	0 10	10	0 8	20	0 4	29	0 4	38	1 4	50	0 4
2	0 4	12	0 6	21	1 4	30	0 6	40	0 4	51	0 8
3	0 4	13	0 8	22	0 6	31	0 4	41	1 6	52	0 4
4	0 4	14	0 4	23	0 4	32	0 4	42	0 4	53	0 4
5	0 4	15	0 4	24	1 0	33	0 4	43	1 0	56	0 4
6	0 4	16	0 8	25	0 8	34	3 0	45	0 4	59	0 8
7	0 10	17	0 4	26	1 0	35	0 4	46	0 4	60	0 8
8	0 4	18	0 4	27	0 4	36	0 4	47	0 10	61	0 10

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£ s. d.		£ s. d.	p ct.
Iron:—					
Welsh Bars, in London	per ton	6 10 0	to	6 15 0	2½
Nail Rods	do	7 5 0		7 10 0	
Hoops	do	8 5 0		8 15 0	
Sheets, single	do	9 5 0		9 15 0	
Staffordshire Bars	do	7 10 0		8 0 0	
Bars, in Wales	do	5 10 0		6 2 6	
Rails	do	5 15 0		6 0 0	net
Foundry Pigs, at Glasg, No 1	do	2 13 6		2 18 0	
Swedish Bars	do	11 10 0		12 0 0	2½
Steel:—					
Swedish Keg, hammered	do	16 0 0		0 0 0	
Swedish Faggot	do	17 0 0		18 0 0	
Copper:—					
Sheet & Sheathing, & Bolts	do	99 0 0		0 0 0	
Hammered Bottoms	do	109 0 0		0 0 0	
Flat Bottoms, not Hamrd	do	112 0 0		0 0 0	
Tough Cake and Ingot	do	95 0 0		0 0 0	
Tile Copper	do	89 0 0		0 0 0	
Best Selected	do	98 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½		0 0 8½	
Fine Foreign	per ton	98 0 0		100 0 0	
Tin:—					
English Block	per cwt.	5 18 0		0 0 0	2½
do Bar	do	5 19 0		0 0 0	
do Refined	do	6 4 0		0 0 0	
Banca	do	6 6 0		0 0 0	
Straits	do	6 1 0		6 2 0	
Tin Plates:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 6	
Second Quality	do	1 7 0		1 7 6	
Coke	do	1 3 0		1 4 0	
Lead:—					
Pig, English	per ton	20 2 6		21 10 0	2½
„ Spanish Soft	do	19 17 6		19 10 0	
Shot, Patent	do	23 10 0		0 0 0	
Sheet	do	21 0 0		0 0 0	
White	do	27 0 0		27 10 0	

Timber, duty 1s. per load, drawback 1s.

Teak ... load	£12 0	£13 0		Archangel, yellow	£13 0	£13 10
Quebec, red pine	3 10	4 10		St. Petersburgh, yel.	11 10	12 0
„ yellow pine	3 10	4 10		Finlan	0 0	10 0
St. John, N.B., yellow	0 0	0 0		Memel	10 0	15 0
Quebec oak, white	5 10	6 10		Gothenburg, yellow	10 0	11 0
„ birch	3 10	4 10		„ white	9 0	9 10
„ elm	3 10	5 0		Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10		Soderhamn	9 10	10 10
„ fir	2 10	3 10		Christiania, per C., 12ft. by 3 by 9 in.		
Memel fir	3 5	3 10				
Riga	3 0	3 5		Christiania, yellow	21 0	23 0
Swedish	2 10	2 15		Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 4
Masts, Quebec red pine	5 0	6 0				
„ yellow pine	5 0	6 0		Pumice Stone pr ton	5 10	9 0
Lathwood, Dantzic, fm	5 10	6 10		**Oils, &c.**		
„ St. Petersburg	8 0	8 10		Seal, pale ... per tun	46 10	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				Sperm body	81 0	82 0
				Cod	54 0	0 0
				Whale, Sth Sea, pale	44 0	0 0
Quebec, white spruce	15 10	18 10		Olive, Gallipoli	60 0	0 0
St. John, white spruce	14 0	15 10		Cocoanut, Cochin	48 0	44 10
Yellow pine, per reduced C.				Palm, fine	36 10	37 0
				Linseed	44 10	44 15
Canada, 1st qual.	17 0	18 0		Rapeseed, Eng. pale	45 0	0 0
„ 2nd do.	11 0	12 0		Cottonseed	33 0	40 0

FRENCH & SMITH, Sworn Brokers, 4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number:—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 28, 1863.

THE BRITISH ASSOCIATION.

The 19th century has been termed, with truth, the social age. It is an epoch of intercommunication; not alone of individuals, but of thought. The civilized world has never beheld such facilities as those afforded during the last sixty years, for the spread of information, the discussion of questions, or the advancement of the arts and sciences. To none of the societies which exist in England, on the Continent, or in America, is science more indebted for its advancement than to that Association which holds its annual meeting this week at Newcastle-upon-Tyne. From the moment of its formation, thirty-two years ago, the list of its members has embraced the greatest names known in almost every branch of science. The British Association has by its labours conferred national benefits which will be remembered long after the donors have sunk to rest; and the position to which it has attained by the truthfulness, accuracy, and value of its reports, and the ability with which its multifarious investigations are conducted, holds out fair promise of a vast extension of its powers in years to come.

The Association traces its origin to Dr. Brewster, who proposed its formation to the Yorkshire Philosophical Society in 1831. He pointed out the great advantages to be derived from the establishment of a National Association for scientific intercourse, to be formed on the German model; and his efforts were warmly seconded by Mr. Robinson, Mr. Forbes, and Mr. Johnson, of Edinburgh, and Mr. Murchison, of London. These gentlemen pointed out that there was no society in existence in Great Britain which pretended to collect observations on a regular system, or form a national catalogue of scattered particulars of any of the sciences. The Yorkshire Philosophical Society, in consequence of the representations of these gentlemen, became the nucleus of the British Association, which held its first meeting in the theatre of the Yorkshire Museum on the 27th of September, 1831, about 300 persons being present, circular letters having been addressed to thirteen societies in London, and twenty-six in the rest of England; Viscount Milton took the chair. Mr. Harcourt, in a kind of inaugural address, thus stated the views of the committee:—"It is proposed to found a British Association for the Advancement of Science, having for its object, to give a stronger impulse and direction to scientific inquiry; to obtain a greater degree of national attention to the objects of science, and a removal of those disadvantages which impede its progress; and to promote the intercourse of men of science with each other and foreign philosophers."

The mere recapitulation of the subjects to which the society has devoted its attention since its formation, would give but a feeble idea of the extent and value of its labours. The series of its printed reports extend to over 30 volumes, and yet they by no means contain a complete record of the works undertaken and conducted at the request and expense of the body. The complete reports occupy not less than 18,000 pages, much of the most valuable information being unfortunately placed out of the reach of the general public by the cost of publication. The amount of money granted for scientific purposes had reached to £20,000 in 1862; and the gratuitous labours of the members would, perhaps, be poorly represented by a vastly greater sum. Two-thirds of the money expended have been devoted to mathematics and physics, from the greater importance of the fields for inquiry presented by these departments of philosophy, and the immense cost of the requisite instruments, and expeditions undertaken to every part of the world. The nation owes to the labours of the Association the possession of three splendid catalogues of stars compiled during eight years, at an expense £1,800. Under the direction of Dr. Whewell, a laborious system of observation, obtained by the influence, and reduced at the expense of the Association, who have aided this work with a sum of about £1,300, has determined the course of the tide-wave in regard to the coasts of Europe, of the Atlantic, of the United States, of New Zealand, and of the east coast of Australia.

The Kew Observatory was presented to the Association by Her Majesty in 1842. Erected by George III., it had been long left useless. Such a donation proved a positive boon. It gave to the society a fixed position, as well as a depository for instruments and papers. The society has in return conducted the establishment with a skill and energy which have raised it to a national importance. All the money which could legitimately be spared from other pursuits has been devoted to the construction and purchase of instruments, and the advancement not only of pure astronomy but also of those kindred departments of science which are not less important, although presenting themselves less prominently. For example, all the barometers, thermometers, and hydrometers required by the Board of Trade are admirably tested, and standard thermometers are graduated, magnetic instruments are constructed, and their constants determined for foreign or colonial observatories. The various expenses connected with this establishment have absorbed about £6,000. The annual allowance for the past seven years having been £500. The suggestion of Sir John Herschell in 1857, that daily photographs should be taken of the sun, led to the construction of the rather remarkable instrument known as the Kew photoheliograph, under the directions of Mr. De la Rue. The British Association lent its aid by the completion of the instrument in 1857, at its workshop in the Observatory, and by giving it a place in the dome. This instrument did good service in Spain during the eclipse of the sun in 1860.

There is scarcely a department of science to which the Association has not devoted considerable attention; and many scientific expeditions have been proposed, undertaken, and conducted to a successful conclusion by its almost unaided efforts. The magnetic survey of the British Islands, commenced and executed from 1834 to 1838, was conducted by a committee of its members—General Sabine, Professor Phillips, Sir J. Ross, Mr. Fox, and Mr. Lloyd, acting upon a suggestion brought before the Cambridge meeting in 1833. The recommendation of the Association, that a Government expedition should be organized to make a magnetic survey in the southern portions of the Atlantic and Pacific Oceans, gave rise to the voyage of Sir James Ross in the years 1839 to 1843; the completion of this survey in 1845, by Lieutenants Clark and Moore; and the magnetic survey of the Indian Seas, by Captain Elliott in 1852, completed, between 1855 and 1858, by Messrs. Schlagintweit.

The importance to our shipping interests of the results obtained, can scarcely be over-estimated; nor did the society rest here, but continuing its labours, the year 1840 saw the establishment through its exertions of the system of simultaneous magnetical and meteorological observations, since well carried out by our own and most of the principal foreign Governments. The sum of £900 was expended between 1840 and 1844 on an important series of experiments, principally carried out by Mr. Scott Russell, on waves. The results, though ready for the press long since, have never been published from want of funds; the great difficulty which hampers most of our societies. Experiments on the strength of materials, the relative strength of hot and cold blast iron, the effect of temperature on their tensile strength, on the effect of concussion and vibration on their internal constitution, carried on principally by the late Mr. Eaton Hodgkinson, at different intervals from 1838 to 1856, have been aided by grants amounting to £400; while botany, zoology, and physiology have absorbed about £1,400, of which nearly £900 has been applied to zoology.

It is impossible to carry our detail further, when speaking of an association so energetic, and so long established. To this and other bodies of scientific men bound together by like ties, England owes much of her supremacy. France, it is true, is distinguished for the eminence of her mathematicians, her chemists, her philosophers. In no nation do we meet with more learned bodies than those who discuss science in her principal towns. The other nations of the Continent are scarcely behindhand in this respect, yet none of these have brought about results tending so generally to national advantage as our own societies—a fact which may perhaps be attributed to the differences in the national character and disposition; our philosophers preferring to deal with and devote their attention to the applied sciences, rather than to those interesting abstractions, for they are little else, in the profound consideration of which our neighbours take so much delight. The British Association affords us an example of a body of men, who, without neglecting science in its most abstract form, have studied it chiefly, in order to its application to our wants as a people. Its members have explored the air, the earth, the heavens; and deriving information on all sides, have communicated it with no niggard hand. Such associations stimulating and aiding each other, tend more to the advancement of knowledge than the labour of thousands of isolated individuals. Union is indeed strength when it exists between philosophers.

We give, elsewhere, an abstract of certain portions of the address delivered by Sir William Armstrong, on taking the President's chair on Wednesday evening. With the speech we are disappointed. From its perusal we have arisen with a feeling of disatisfaction. Sir William supplied his hearers with a Barmecide's feast of knowledge; and we question if any one present felt his appetite, we will not say for knowledge, but for information, satisfied as he could have wished. We are well aware of the extremely difficult task which the composition and delivery of a speech of the kind involves; but the greater this difficulty, the greater the honour to him who successfully overcomes it. Sir William Armstrong's speech contains not one original suggestion of the slightest value; and, as a recapitulation of the progress made by science within the last twenty-five years, it is extremely superficial. In dwelling on mechanical science, he has scarcely been orthodox—a circumst[illegible] we would have passed over had he [illegible]

which he was not. Taking, apparently, the steam-engine in its present imperfect form, Sir William, echoing old theories, more than hints at the possibility of producing machines capable of developing power with much greater economy. It requires little calculation to show how erroneous are such conclusions, when we reflect that much less than one-half pound of coal can produce a horse-power per hour in theory, and that 1·5 lb. has done so in actual practice, we can easily conceive how unlikely it is that the steam boiler and furnace will be superseded by the electrical battery. At a time like the present, when it is of the last importance that we should reduce the size and weight of our engines to the lowest possible limit, it is folly to predict the introduction of the cumbrous and unwieldy caloric engine. Sir William's speech, however, if it has done no good, is not likely to do harm; and with such a conclusion we must rest content.

WELDING BOILER PLATES.

THE march of improvement in the formation of plate iron structures is decidedly slow. New forms of wrought-iron bridges present themselves daily. Novelty in external shape, and internal arrangements, can easily be found in our iron ships. Steam boilers appear under a thousand varied shapes; patents are taken out continually for improvements in fire-boxes, in flues, in grates, in boilers themselves, and in everything which appertains ever so remotely to them. But the actual method of putting a wrought-iron bridge, or a ship, or a boiler together—of fastening and combining their parts so as to render each a complete structure—remains in much the same state in which it existed 50 years since. A working boiler-maker who was considered skilled in his trade in the days of Watt would, we imagine, experience little difficulty in maintaining his reputation in the present day, for, of all trades, this perhaps has progressed least. The old waggon or haystack boiler was put together by rivets, in precisely the same way that the modern mechanic builds up that of a first-class locomotive, and for all that we can see, the rivetted joint will be as habitual in fifty years as it is now. The prevalence of a custom goes for nothing as a proof of its necessity or its correctness. The endurance, and well-nigh universal adoption, of a certain principle of construction, for years, is no evidence whatever that it may not be superseded with advantage; and it is high time that boiler construction, leaving aside ships and bridges for the present, should partake of some of the changes and improvements which the advance of the arts place at our disposal.

The employment of rivets for securing metal sheets or plates together, is of extremely ancient date. The principle must have been obvious to the first workers in iron, and being really susceptible of very little improvement, the art, if such it can be termed, has been handed down from generation to generation without alteration. Almost the only difference between the boiler seam of a century ago, and that of the present day, is found in the use of the "snap," for finishing the rivet point. We are not aware of the existence of any very old structures of plate iron which have the rivets so finished. "Snapping" a rivet, only adds to the finish of a joint, but in no way conduces to its strength, and can scarcely be considered in the light of a substantial improvement.

Until a comparatively recent date, the belief obtained with most engineers that a rivetted joint, if the work were properly executed, was superior in strength to the plate itself—an assumed fact which they endeavoured to account for, on the ground that the contraction of the rivet during the process of cooling, bound the two surfaces in contact so closely together, that the friction between them prevented the exertion of much shearing force on the rivets, and compensated for the weakening occasioned by punching the necessary holes near the edges of the plates. The fallacy of these arguments was often demonstrated by the failure of rivetted joints while the plates remained intact. Nevertheless, the advocates of the theory held out strongly in support of these views, until Mr. Fairbairn conducted a very valuable series of experiments, which resulted in proving, that the strength of the plate being taken as 100, that of a double-rivetted joint will be 70, and that of a single-rivetted joint 56. This, be it remembered, with first-rate workmanship. American engineers have tested the real value to be attached to the friction between two surfaces rivetted together as in ordinary seams, with the exception that the holes were made oval in the direction of the strain for the purpose of experiment. A very considerable force was required to cause the plates to slip on each other, but this fact did not affect the results in the least. They amply confirmed those given by Mr. Fairbairn. 56 per cent. of the whole strength of the plates which form a steam boiler is certainly not much to realize with the best workmanship; but as many of our boilers and ships are put together, even this per-centage must be regarded as too high. There are difficulties involved by the nature of the process which the best mechanic can only combat, seldom or never overcome. However accurately two plates may correspond before the holes are punched, that process inevitably distorts them, and occasions a bad fit when subsequently put together. The hammering and bending at the edges entailed, is invariably injurious to cold plates. Again, the best possible workmen, with the best machinery, find it out of the question to make all the holes in a long seam correspond. The constant use of the drift is a result certain to follow; and when plates are of inferior quality or very thin, and the holes near the edge, cracks are frequently established from one to the other. The judicious use of the caulking chisel easily conceals the defect, which is none the less serious because it is invisible. Even the drift often fails, however, to secure the entrance of the proper rivet, and one made of lead is the substitute. The best rivets, too, seldom completely fill the holes they occupy. They are seldom or never truly at right angles to the plates, and are often exposed to an enormous strain in drawing plates together where they are badly fitted. We have seen from this cause, the heads fly off half a score of "Best Best" rivets at once in rolling a new boiler from one side of a shed to the other. When we take all these circumstances into consideration, we believe that 46 per cent. of the strength of the plates, will pretty accurately represent that of the seams of a very large proportion of our boilers if single-rivetted, as most of them are.

Impressed with the evils of such a system, Mr. Fairbairn introduced the use of iron plates rolled with thickened edges, to compensate for the loss of strength entailed by the holes. The objection to their employment he sums up in a few words:—"At the commencement of the trade in iron shipbuilding I patented an arrangement for rolling plates with thick edges, and employed plates so prepared to some extent; but the cost of production at that time and some difficulties in their employment prevented their general use." The whole principle, indeed, of rivetting boilers is so erroneous that it is scarcely susceptible of much improvement.

Within the last few years, attempts have been made with more or less success to unite the plates of boilers, ships, &c., by welding, instead of rivetting. The first English patent, apparently, which touches on the subject, was taken out 1825, by a Mr. Whitehouse, for welding tubes "by circumferential pressure without a mandril." The next was by Stratton in 1844, for welding plates to form hollow ribs for ships; which the patentee proposed to effect, by rolling strips of metal concave, with flanges; which strips of metal being placed with their concave sides towards each other, and the flanges being welded together, formed tubular ribs for ships, &c., as proposed. Some of the first locomotives built by Bury had welded joints. A patent was obtained by William Bertram in 1854, which seems to be the first proposing the application of a gas flame urged by a blast, to the heating of plates to be welded. The patentee scarfed the edges of the plates, placed them together, and directed two pure gas flames, obtained by the combustion of coa or coke in suitable furnaces, on either side of them until raised to a welding heat, when they might be united by pressure or hammering. William Morgan patented nearly the same process in January, 1856. Russell, in 1859, proposed to employ a framing with two arms; the lower one supporting a convex tool or anvil, which going inside of, aided in sustaining the boiler being welded, its weight chiefly resting on rollers, which were fixed near the ground. The upper arm carried another tool or hammer with a convex face, which was traversed up and down in vertical slides, on much the same principle as that involved in Ryder's forging machine. Two portable gas furnaces were provided, one within, the other outside the boiler, to raise the plates to the welding point. The whole apparatus appears to have been simple and well-contrived; but from some cause it has not come into general use. Alleyne, in December, 1859, patented an invention for welding boiler plates, by the intervention of a "glut," which consisted of a bar of iron, with a cross section resembling I. The edges of the plates to be welded were inserted into the grooves, which aided in retaining them in their place. The whole was then exposed to suitable gas jets, and raised to a welding heat and united by the pressure of rollers or by the hammer. The "glut" was intended to prevent the oxidation of the plates; a needless precaution, as flame is incapable of oxidating a metal surface. Still there are certain matters of practical convenience, which incline us to the belief that the principle involved in this patent may be occasionally employed with advantage, particularly in welding transverse seams in circular boiler shells.

There can be no doubt that there are many difficulties to be overcome, before welding will be received by the practical boiler-maker as an efficient substitute for the rivet. Plates heat unequally, buckle, blister, and frequently become exposed, while hot, to the air for a space of time sufficient to provide a coat of oxide fatal to the future joint. Such obstacles are too important to be passed lightly over; still less should they be regarded as insurmountable. They embrace nothing more than the usual troubles which attend on the introduction of any novel process. To combat them properly certainly requires patience, energy, some talent for invention, and a certain amount of capital, for all of which it is reasonable to ex-

pect a satisfactory return when the process has been perfected by their expenditure. The difficulties involved are, after all, by no means serious. It is easy enough to raise a square foot or so of thin boiler plate to a welding heat; that once attained, simple pressure alone is necessary to ensure a joint equal, if not superior, in strength to the plate. By the adoption of this principle, we could reduce the thickness of our boiler plates by one-half, rendering them lighter, and more easily handled and worked in every way. The expense incurred should not be higher than that of the rivetted joint. The extra trouble of fitting and scarfing would not equal that of punching; and the fuel consumed in rivet-making and heating would nearly suffice for welding. Engineers must remember that the principle is neither new nor untried; that it has been, and is worked practically, and only requires to be introduced more generally—not originated. Thus, the boilers of Shand and Mason's fire-engines are welded. Beyer and Peacock weld many of their locomotive boilers. The art is nearly as old as the steam-engine; and although it has lain dormant for years, we trust that it will ere long become almost universal in its application to steam boilers of every kind. There are, it is true, certain situations to which it is inapplicable. Different joints may be found in almost every boiler, save the simple cylinder, which can be joined better by rivets than by any other expedients; but these are exceptional, and, as a general rule, we may consider that no difficulties stand in the way, save those which are easily overcome by moderation in our aim, and such an amount of skill and energy as is commonly to be met with among our working engineers.

THE ENGLISH AND FRENCH NAVIES.*

The wise wish to "see ourselves as others see us," is sometimes realized by the perusal of the writings of an able contemporary foreigner; and a comparison instituted between the naval forces of France and Great Britain by a Frenchman of honesty and ability, could scarcely be without interest, even if it did not free us "frae mony a blunder and foolish notion." M. Xavier Raymond's work—dedicated *aux Marins de la France*—is no production of a monomaniac like, for instance, the Marquis de Boissy. While feeling warmly as a Frenchman, and justly proud of the achievements of the French Navy during the last half-century, he candidly does justice to the immense latent resources of England, and principally blames for our naval shortcomings the British Admiralty, that "inert indolent body, with inordinate powers of consumption, and with proportionately small powers of production; condemned by its very constitution to improvidence and surprises, and possessing very little faculty to keep its affairs in order."

According to the preface the main objects of this work are, in the first place, to refute England's claims to a limitation of the naval forces of other nations; to show how France has developed her Navy since 1815, and that England has been obliged to follow every step if she did not wish to be left behind in the race; to examine into the causes of our recriminations against the French Navy; to warn France against too great a confidence that would lead her to underrate England's naval power; and, lastly, to point out a fatal error in the means adopted in recruiting the naval war service of the French. Without further entering into the political side of the question, we may state that M. Raymond takes a reasonable view of the naval preponderance of England; he acknowledges that it is our duty to perpetuate that preponderance, but he refuses to receive it as a part of international law to be recognized by other Powers; we must maintain it by our own practical exertions.

M. X. Raymond shows that every important advance in maritime construction since 1815 has had its origin in France; and England, the then Mistress of the Seas, has had France for her *institutrice* in the principal maritime improvements made from that date up to the present time. "The improvements in the build of sailing ships, and in the details—such as Barbotin's capstan—are all of French origin. When the application of the propeller allowed of building real steam war-ships, the first model was a French ship, the 'Napoleon.' The iron-clad batteries proposed by the Emperor of the French having shown at Kinburn the value of iron armour for defence, France thereupon built the 'Gloire,' the first type of an iron-cased fighting ship, which, in the words of M. Dupuy de Lôme, would be 'like a lion among a flock of sheep, when encountering a whole fleet of wooden ships.' In the means of attack, France, after furnishing Paixhan's guns against wooden walls, was the first to actually employ the rifled gun as an ordinary weapon; and the 'Gloire' herself is now furnished with 36 rifled *breech*-loading guns. The only improvements of English origin are Cunningham's system of reefing sails, and Clifford's plan for boats." This review, truthful as it is in the main, is certainly not gratifying to our national pride.

The third essay is devoted to the application of the screw as a marine propeller, and to a claim for France of the invention of the marine engine itself and of its screw. The history of invention has yet to be written; but had we space we could show that M. Raymond herein annexes rather too much for his countrymen. Floating batteries and iron-clads are next treated on by the writer, and after numerically giving the dimensions and armament of the "Gloire," and the "Warrior" respectively, he institutes a comparison between the two vessels, to the disadvantage of the latter. The "Warrior" "is a horse too big for its stables," from our inadequate dock accommodation for such a large vessel; she can only carry coal for six days' consumption, against the eight days' of the "Gloire; only two-thirds of the vessel and 13 of the guns are protected with armour; the well for throwing the screw in and out of gear, "is a solution of continuity of the vertebral column of the vessel;" the use of sails and cordages is a source of weakness to a steam-vessel with a propeller, as a piece of rope accidentally driven in by the propeller may completely disable the latter. This was shown in the case of the French vessel, the "Isly," which had to be docked in order to remove a piece of rope entangled with the screw. M. Raymond also points to the inferior performances in practice of the "Warrior," as compared with the "Gloire." With regard to the 68-pounders composing the armament of the "Warrior," he states that careful experiments conducted with these guns at Vincennes have shown that they could not penetrate plates 12 centimetres (4¾ in.) thick at a distance of 300 metres—an achievement accomplished by the ordinary French rifled guns at a range of 1,000 metres. The opinions of several English engineers are quoted as an affirmation that our iron is much inferior to that produced on the Continent; and it is stated that iron plates from the same works as those of the "Warrior," when tried against similar plates to those furnished by Petin and Gaudet for the "Gloire," proved themselves greatly inferior to the latter in their powers of resistance.

In an examination of the Armstrong gun, as compared with other rifled artillery, he states that the French officers who had an opportunity of witnessing its performances in China give very unfavourable accounts of this kind of ordnance; while our author recalls to our memory that the report of Major Hay—specially sent to China to examine into the practical working of Armstrong's gun in front of the enemy—is not yet published, although the Government has been often called upon to do so—a very significant fact. He justly characterizes Armstrong's gun as being "an effort to transform into a cannon the *old-fashioned rifle with a forced ball*." M. Raymond gives the preference to Whitworth's gun, which he asserts to be a mere modification of the rifled gun introduced into the French service by Colonel Treuille de Beaulieu, who began experiments with this kind of improved ordnance so long ago as the year 1842. It is the old story of necessity forcing a recourse to superior organization and science for an amelioration of natural deficiencies. Just as French cooks make up for the bad meat by good cookery, Frenchwomen their general lack of beauty by careful dressing, French soldiers their deficient *physique* by thorough training, so does the French Navy make up its want of ingrained maritime genius by a thoroughly scientific organization.

M. Raymond does not agree with the shallow assertion that steam power has re-established an equality on the seas. On the contrary, the introduction of steam-vessels is to the advantage of the maritime preponderance of England. Could any Power of the second order—for instance, Holland—again offer a naval combat such as that of Camperdown? The Dutch do not possess a single steam line-of-battle ship nor a single iron-clad frigate, nor could they afford the expense of ships able to meet the present naval armaments of England in the same way as those of the brave and unfortunate Admiral de Winter. Again, although the picked seamen, the topmen of old, are no longer required on the present battle ships "as bare as pontoons," the engineers, the firemen, coalers, &c., will want quite as much strength, address, courage, and experience, and especially knowledge, as the best able seamen of former times.

It requires as much strength to live in the "hell" of the furnaces, and as much agility to pass amidst the working parts of the engine in motion, as to reef the sails in a storm; while more intelligence is demanded to work and repair the engines. In the same way, the fatigue of taking in the coal for the engine exceeds anything required from the men in the old sailing vessels. Serving the new guns—firing two shots a minute to the two shots every five minutes of the old ordnance—is also more laborious, and demands more physical power from the sailor than under the old system. The weight of the projectile is doubled; the charge of powder is increased; the guns themselves are heavier, and have to be fired at an enemy in continual motion—moving at a speed of perhaps 14 miles an hour. The vessels of the fleet itself will no longer fight in order of battle at a cable's length apart, but can almost touch each other and manœuvre like a line of infantry—shoulder to shoulder. Blockades will no longer be raised at the slightest symptom of bad weather, but will be

* *Les Marines de la France et de l'Angleterre.* Par Xavier Raymond. Paris and London. 1863. (The greater part of Mr. Raymond's book appeared last year in four numbers of our highly-esteemed contemporary, *La Revue des Deux Mondes.* See the numbers for the 1st and 15th of June, and the 1st and 15th of July, 1862.)

continually maintained without losing sight of the coast. It appears that the French naval administration has arranged a regular system of naval tactics; founded upon the present possibility of manœuvring ships like so many individual soldiers or regiments. We thus see that that the facilities given by steam have increased the demands upon the power of the sailor, and this is so far favourable to our country from the undoubtedly superior *physique* of our own sailors.

The maritime power of any nation is a product of three factors:—money; fully developed manufactures; and a population of seamen—itself a result in direct proportion to the commercial navy of each people. At sea, still less than elsewhere, could individual energy and enthusiasm supply the want of money. At the beginning of the century, the English—by dividing the total expense of a fleet by the number of its guns—reckoned that each gun came to £1,000. This estimate rose to £5,000 and £6,000 in the steam line-of-battle ships; and it is now more than £10,000 for each broadside gun in the iron-clad frigate "Warrior." The "Warrior" has cost £400,000, and she is only partially protected by 4½ in. plates; the "Minotaur" with her 5½ in. plates will represent £500,000 of the public money—and similar plates have been shattered by projectiles. The cost of ships with 8 in. or 10 in. plates will be still higher, and it will thus be "impossible to be a maritime power without the disposal of a heavy budget, and a power of obtaining heavy sums at any given moment." A command over capital is not, however, sufficient; the help of manufactures in a high state of development is absolutely required. "The movement towards an increasing use of iron for all kinds of shipbuilding, is continually narrowing the relations between naval warfare and industry—between what was formerly a world of itself and what is now the ordinary state of things; between the powers of warfare and the powers of production of the workshops cultivating by preference the arts of peace." Nearly all these workshops can become engines of war of incalculable power; "like the industrious bee armed with a sting for the defence of her honey," the workers can turn round with dreadful energy on the disturber of their peaceful labour. The Russians experienced this in 1855, and were, nevertheless, only at the outset of what was being prepared against them, when they saw themselves forced to yield to the demands of their adversaries. Notwithstanding the number and valour of their troops fighting on the national soil, they were crushed by the immensity of warlike materials belched forth with such speed by the far-off workshops of France and England. The same thing is going on in the United States. Not less brave than their enemies, and, perhaps, having more military spirit, and fighting at the same time for their homes—theConfederates are obliged to recoil before the gunboats of the Federals, the superiority of their armaments, and before the results of the blockade depriving the Southern States of the means of renewing their materials of warfare. The Southerners are thus learning by experience that a country may be rich, and yet find itself at a disadvantage in war without the manufactures for arming, equipping, clothing, and feeding an army of soldiers." Should a great war now break out, its principal characteristics would consist in the inexhaustible fecundity with which the manufacturing powers of each state could produce the war materials of the belligerents; and the might and suddenness of the blows given at the outset by the aid of industrial agencies. The largest anchors, engines, and iron-plates are manufactured in the private establishments of France—and private firms play a still larger part in England. The foundries turning out the large and ponderous shafts for 11,000-horse power engines would make light work of guns and anchors of the largest size.

The most brilliant essay in the book is that in which M. Raymond shows up the British Admiralty—"that gossiping old woman, two hundred years behind the pettiest engine-maker of the country." The inferiority of British fleets in the ships composing them; in their interior organization; in the performance of manœuvres; in the disgraceful mutinies of late years; in retrograde character of the construction of the vessels; in the dangerous advances given to France in the adaption of steam and armour to naval warfare; are all owing to that "least rationally constituted administrative body of any other country—one of the most singular institutions in the world, and the most fatally condemned to consume immense resources in the production of comparatively slight results." The only cleverness shown by the Admiralty consists in its usual dodge, whenever the French naval administration is in advance through the adoption of any new invention. "Instead of acknowledging its faults, the Board accuses France of projects of invasion and conspiracy; and having sufficiently disturbed the minds of the nation, the Admiraly then obtains the millions required to make up for its past blunders." We have not sufficient space to at present develop M. Raymond's bill of indictment against this plague-spot of our administration; it may be sufficient to say that all patriotic Englishmen will cordially subscribe to his statements. He does not omit showing up a great mistake in the naval adminstration of his own country. According to the French law of the *inscription maritime*, every Frenchman in the least way connected by his daily occupation with a seafaring life, is every instant liable—from the age of 18 to 50—to be pressed as a seaman and to be sent to the Antipodes in any of the Imperial vessels. This law has undoubtedly acted like an incubus, for the last two hundred years, on the development of the French Navy. According to the late statements in the French Senate of Admiral Romain-Desfossés, France could only reckon upon 62,000 able seamen in all, against the 80,000 kept by England in times of peace under her war-flag, and the 230,000 English sailors employed in long sea voyages and the coasting trade. By applying to the whole seafaring population the laws of the French "Inscription Maratime," counting the small coasting trade, fishermen, boatmen, and workmen in the dockyards, England could reckon on 700,000 to 800,000 men.

This book is, indeed, well worthy to be read by all seamen. Although not a seaman himself, M. Raymond has had much to do with naval matters. He was attached by M. Guizot to the Mission of M. de Lagrénée to China, about twenty years ago; he has made many sea voyages; and he informs us that he has studied for the last twenty-five years the naval question, and has had much personal intercourse with naval men.

IRON SHIPS AND IRON-PLATING.

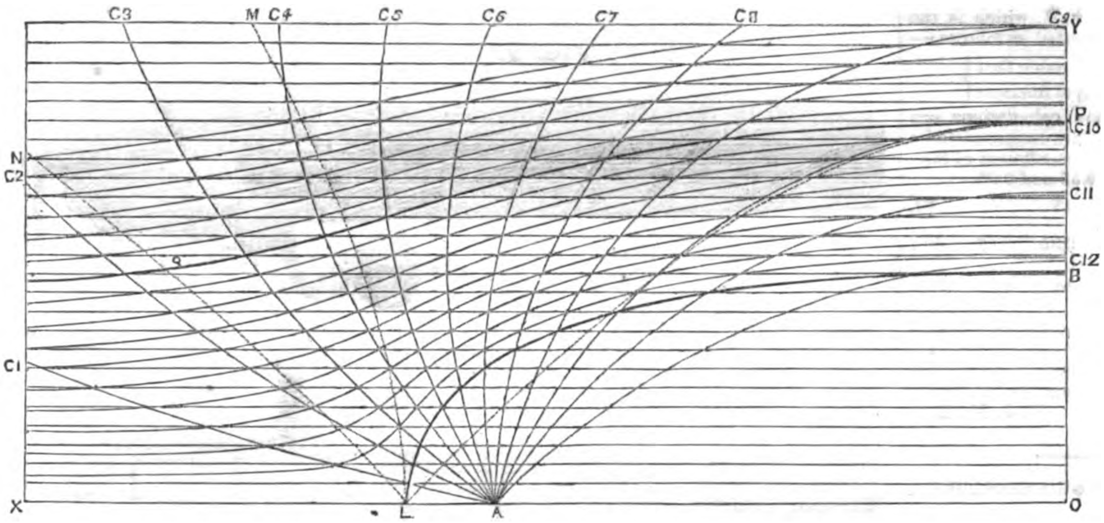
(From the *Times*, August 22, 1863.)

The following extract from the Mechanics' Magazine of Satuday, June 5, 1824, shows how completely the idea of what are considered modern discoveries was anticipated by scientific writers forty years ago. It would seem as if forty years represented the necessary time between the conception and the execution of an idea:—

"Since the discovery by Mr. Perkins of so vast a destructive power as his steam artillery, it becomes of more importance than ever that nations should learn to make their ships as shot and shell proof as possible. On this subject there is, in Ferusac's *Bulletin des Sciences Technologiques*, a memorial by M. de Montgery, a captain in the French navy, which is well worthy of attention, and from which chiefly we shall extract the materials of the present notice. The authors object is to recommend the universal adoption of iron instead of wood in the structure of ships. A multiplicity of objects formerly composed of wood are now formed of iron—bridges, arches, aqueducts, public highways, and other objects not so colossal, but very important in their application to maritime affairs, such as wrought-iron tanks and hollow cylinders for masts and yards, and chains in lieu of hempen cables and cordage. But why up to this time have there been so few vessels constructed entirely of iron? Will not mankind at some future period wonder how enlightened nations could have thought of building objects so stupendous and so expensive with so fragile and perishable a substance as wood, while they possessed a material to substitute for it so solid and durable as iron? The ordinary term of duration of wooden ships is twenty years, and during that period they must be hove down and thoroughly repaired three or four times. To the duration of an iron ship, on the contrary, it would be difficult to assign any period. Vessels of this description have no need of caulking, or copper bottoming. Little subject to leaks there is less fear of their running ashore; and still less are they subject to the casualty of fire. The first cost of them might be greater (that we doubt), but from their far greater durability, and standing so little in need of repairs, the saving in the end would be immense. It deserves further to be considered that large timber is becoming every day more and more scarce, while from the increased dimensions of new ships more wood is required in shipbuilding; of iron, on the contrary, the stores are inexhaustible. It may be said that the adoption of iron would serve to uncraft or disqualify a numerous body of men (the shipwrights), and throw them for a time out of employment. A temporary inconvenience to a few ought not, however, to be opposed to a great general good, considering, moreover, how much the country at large would gain by the increased activity which this new demand for iron would give to our mines commerce, and agriculture.

"M. Montgery contends that while we have vessels of war constructed of wood they should at least be plated with iron, and it will be seen from the following passage that he had distinctly anticipated such an application of projectile force as that discovered by Mr. Perkins:—'For more than 350 years it has been in agitation to throw shells from mortars horizontally, instead of elevating them according to the general practice. The adoption of howitzers in the field of battle, independently of a great number of special experiments, has at length proved beyond doubt the importance of this mode of firing, which it has also been proposed to adopt on board of ships and on marine batteries.' Long before any one had thought of substituting metal for wood in the construction of large vessels, plates of iron or brass had been used for covering ships of war and battering-rams. The celebrated galley built by Archytas and Archimedes for Hiero, tyrant of Syracuse, was cased in this way. Philo, of Byzantium, afterwards proposed using battering-machines made entirely of metal; but Father Mersenne appears to have been the first who thought of adopting them for ships. M. Montgery says that to render the sides of a vessel shot and shell proof they should have a plating of iron about 6 in. thick—that is, a series of sheets of iron, with blocks of cast-iron between. He conceives that the block would only be necessary in the parts exposed to the fire of the enemy, and that there would be no occasion for them towards the keel of the vessel."

PLANE WATER LINES.



ABSTRACT OF AN INVESTIGATION ON PLANE WATER-LINES.*

By W. J. Macquorn Rankine, C.E., LL.D., F.R.SS.L. & E., &c.

1. This Paper contains an abstract of a mathematical investigation which has been communicated in detail to the Royal Society. By the term "plane water-line" is meant, one of those curves which a particle of a liquid describes in flowing past a solid body, when such flow takes place in plane layers. Such curves are suitable for the water-lines of a ship; for during the motion of a well-formed ship, the vertical displacements of the particles of water are small, compared with the dimensions of the ship; so that the assumption that the flow takes place in plane layers, though not absolutely true, is sufficiently near the truth for practical purposes.

2. The author refers to the researches of Professor Stokes (Camb. Trans., 1842), "On the Steady Motion of an Incompressible Fluid," and of Professor William Thomson (made in 1858, but not yet published), as containing the demonstration of the general principles of the flow of a liquid past a solid body.

3. Every figure of a solid past which a liquid is capable of flowing smoothly, generates an endless series of water-lines, which become sharper in their forms as they are more distant from the primitive water-line of the solid. The only exact water-lines whose forms have hitherto been completely investigated, are those generated by the cylinder, in two dimensions, and by the sphere, in three dimensions. In addition to what is already known of those lines, the author points out, that when a cylinder moves through still water, the orbit of each particle of water is one loop of an elastic curve.

4. The profile of waves have been used with success in practice as water-lines for ships, first by Mr. Scott Russell (for the explanation of whose system the author refers to the Transactions of the Institution of Naval Architects for 1860-1-2), and afterwards by others. As to the frictional resistance of vessels having such lines, the author refers to his own Papers; one read to the British Association in 1861, and printed in various engineering journals, and another read to the Royal Society in 1862, and printed in the Philosophical Transactions.

5. The author proceeds to investigate and explain the properties of a class of water-lines, comprising an endless variety of forms and proportions. In each series of such lines the primitive water-line is a particular sort of oval, characterized by this property—that the ordinate at any point of the oval is proportional to the angle between two lines drawn from that point to two foci. (In the figure, LB represents a quadrant of such an oval; O being its centre, and A one of the foci. The other focus is at an equal distance to the other side of the centre.) Ovals of this class differ from ellipses, in being considerably fuller at the ends, and flatter at the sides.

6. The length of the oval may bear any proportion to its breadth, from equality (when the oval becomes a circle) to infinity. (In the figure, the length OL is to the breadth OB, nearly as 17 : 6).

7. Each oval generates an endless series of water-lines, which become sharper in figure as they are farther from the oval. In each of those derived lines, the excess of the ordinate at a given point above a certain minimum value, is proportional to the angle between a pair of lines drawn from that point to the two foci.

8. There is thus an endless series of ovals, each generating an endless series of water-lines; and amongst those figures, a continuous or "fair" curve can always be found, combining any proportion of length to breadth from equality to infinity, with any degree of fulness or fineness of entrance, from absolute bluffness to a knife-edge.

9. The lines thus obtained present striking likenesses to those at which naval architects have arrived through practical experience; and every successful model in existing vessels can be closely imitated by means of them, from a Dutch galliot to a racing-boat.

10. Any series of water-lines, including the primitive oval, are easily and quickly constructed with the ruler and compasses, as follows:—Parallel to the longitudinal axis OX, draw a series of straight lines at equal distances apart. Through the foci, draw a series of circular arcs AC^2, AC^2, &c., so as to contain a series of angles found by dividing those distances by

$$\frac{OL^2 - OA^2}{QOA}.$$

Each of those circular arcs indicates the direction of motion, in still water, of each of the particles that it traverses. Then through the angles of the network formed by the straight lines and circular arcs, draw a series of curves; these will be the required water-lines.

The centre of curvature of the oval at L is the focus A.

11. The following curves, traversing certain important points in the water-lines, are exactly similar for all water-lines of this class, and are easily and quickly constructed with the compasses.

LM is a hyperbola, having a pair of asymptotes crossing the axes at O at angles of 45 deg. It traverses all the points at which the motion of the particles, in still water, is at right angles to the water-lines.

LQN, and LP, are the two branches of a curve of the fourth order, having a pair of asymptotes which traverse O, making angles of 30 deg. with OX. A straight line joining L and P makes an angle of 30 deg. with LO. The two branches cross the axis OX as L, making angles of 45 deg. The branch LQN traverses a series of points at each of which the velocity of gliding of the particles of water along the water-line is less than at any other point on the same water-line. The branch LP traverses a series of points, at each of which the velocity of gliding is greater than at any other point on the same water-line.

12. The axis OY, from B to P, traverses a series of points of minimum velocity of gliding: from P onwards, it traverses a series of points of maximum velocity of gliding.

13. Every water-line, complete from bow to stern, which passes within the point P, has three points of minimum and two of maximum velocity of gliding; while every water-line which passes through or beyond P, has only two points of minimum and one of maximum velocity of gliding. Hence the latter class of lines cause less commotion in the water than the former.

14. On the water-line PQ, which traverses the point P itself, the velocity of gliding changes more gradually than on any other water-line having the same proportion of length to breadth. Water-lines presenting this character can be constructed, with any proportion of length to breadth, from $\sqrt{3}$ (which gives an oval through L and P) to infinity. The finer of those lines are found to be nearly approximated to by wave-lines; but are less hollow at the bow than wave-lines are.

15. The author shows how horizontal water-lines at the bow, drawn according to this system, may be combined with vertical plane lines of motion for the water at the stern, if desired by the naval architect.

16. In this, as in every system of water-lines, a certain relation (according to a principle first pointed out by Mr. Scott Russell) must be preserved between the form and dimensions of the bow and the maximum speed of the ship, in order that the appreciable resistance may be wholly frictional, and proportional to the square of the velocity (as the experimental researches of Mr. J. R. Napier and the author have shown it to be in well-formed ships), and may not be augmented by terms increasing as the fourth and higher powers of the velocity, through the action of vertical disturbances of the water.

ABSTRACT ON THE PROPORTIONS OF SHIPS OF LEAST SKIN-RESISTANCE FOR A GIVEN SPEED AND DISPLACEMENT.*

By W. J. Macquorn Rankine.

The author referred to a previous Paper, which he had read to the British Association in 1861, and in which he had stated the results of a theoretical investigation of the "skin-resistance" of ships, and verified those results by a comparison with those of experiments. In the course of that Paper he had stated that the theory gives, for the proportion of length to breadth which produces least skin-resistance with a given displacement of speed, that of *seven* to *one* nearly.

This is the case *when the figures and proportions of the cross-sections are given*, so that the draught of water bears a fixed proportion to the breadth. But *when the draught of water has a fixed absolute value*, the theory gives a somewhat different result; for the proportion of length to breadth which produces the least skin-resistance is found to increase as the draught of water becomes shallower.

* Read to the British Association in August, 1863.

* Read to the British Association, August, 1863.

In the following table of examples, L denotes the length, B the extreme breadth, H the draught of water, and the ratio $\sqrt{LB} \div H$, which is the argument of the table, is computed as follows:—

$$\frac{\sqrt{LB}}{H} = \sqrt{\left\{\frac{\text{Displacement in cubic feet}}{H^3 \times \text{co-efficient of fineness}}\right\}}.$$

In the vessels to which these calculations are applicable, the cross-sections are supposed to be nearly rectangular, and the "co-efficient of fineness" is in general between 0.55 and 0.65.

xample No.	I.	II.	III.	IV.	V.	VI.
$\frac{\sqrt{LB}}{H}$ =	5·2	9·9	15·6	22·5	30·7	40·2
$\frac{L}{B}$ =	7	8	9	10	11	12
$\frac{B}{H}$ =	2	3·5	5·2	7·1	9·3	11

The general agreement of these results with successful practice in shipbuilding is obvious.

W. J. M. R.

Glasgow, August 17, 1863.

STORM'S BREECH-LOADING ORDNANCE.

FIG. 2.

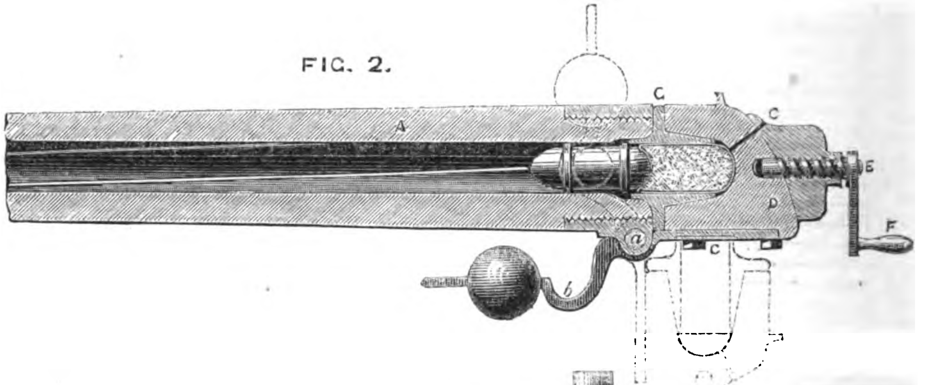
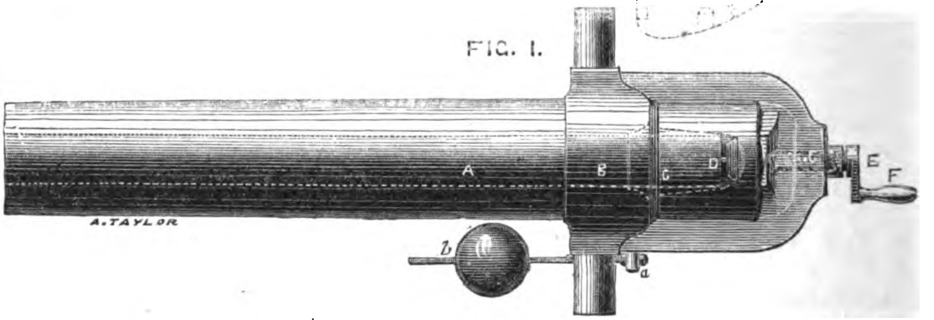


FIG. 1.



As a company is being formed to introduce this system of breech-loading, we illustrate it this week. The invention is patented by Mr. W. M. Storm, of New York.

It relates, firstly, to improvements in breech-loading cannon, whereby they will be effectually secured against the escape of lateral fire during a discharge, and the operation of loading the gun will be greatly facilitated.

The main object of this part of the invention is the application of the gas check or valve, which consists of a loose tubular lining which fits into the barrel of the weapon and covers the junction between the barrel proper and the breech piece, and being capable of an endway movement, by reason of the expansive force of the ignited powder, will completely seal the joint between the breech and barrel.

In applying the gas check or valve to breech-loading canon, the patentee adopts the arrangement shown in the accompanying drawings, where fig. 1 is a plan view of the improved cannon; fig. 2 is a longitudinal section of the same.

A is a barrel of the cannon, provided at its inner or rear end with a screw thread, which takes into a hollow screw tapped in the breech frame B. This hollow screw or ring carries the trunnions, and forms the forward end of the breech frame. On the under side of the trunnion ring two lugs are formed to receive a transverse axle *a*, which passes through a similar lug formed on a hinge piece C, attached to the moveable breech D. Keyed to this axle is a weighted lever *b*, which serves to counterbalance the breech, and thereby facilitates the working of the gun. The rear end of the breech frame B is tapped to receive a quick screw E, which is operated by a winch handle F, and enters a hole bored in the rear end of the breech, for the purpose of securing it in position when the cannon has been charged. A recess is made in the breech chamber to receive the gas check or valve G, the front end of which projects into the barrel. The vent *c* for firing the cannon is carried through the breech frame to give access for priming, so that if by any chance it is attempted to fire the charge before the breech is brought "home" or to its proper position, the vent will be closed by the hole in the breech frame not being in coincidence with that of the breech. To charge the cannon, withdraw the screw bolt E by means of the winch handle F, and let the breech fall into the dotted position of fig. 2, when the valve G will come away with the breech. In the breech chamber, contracted by the insertion of the valve G which forms a lining thereto, the cartridge is placed, and the shot or shell is inserted in the barrel of the cannon through the now open rear end; then, by means of the weighted lever *b*, raise the breech into position, as shown at fig. 2, and secure it there by the screw bolt E. The cannon is then ready for firing. For adjusting the cannon to the proper angle for firing, the elevating screw or analogous device is provided in advance of the trunnions instead of in rear thereof, as heretofore.

It will be understood that the barrel of the cannon may have a smooth bore or be rifled as thought most desirable, and that shots or shells of any suitable construction may be employed therewith. The part of the gas check or valve G, which overlaps the rear end of the barrel, is, by preference, formed with a curved face, the curve being struck from the axis of the supporting hinge.

The principle is not less applicable to rifles or small arms than to guns. As applied to rifles of the regulation pattern, the arrangement of parts is extremely simple and unlikely to get out of order, one so constructed having been discharged 300 times consecutively at the late meeting at Wimbledon, as quickly as it could be loaded, with the most satisfactory results. Further information may be obtained from Mr. F. A. Braendlin, 3, Rood-lane.

TRIAL TRIP OF THE "AURORA."

The trial trip of this fine twin-screw steamer took place on Tuesday last. The "Aurora" is an iron vessel, 165 ft. in length, with a beam of 23 ft., a depth of 13 ft. 6 in., an area of midship section of 150 square ft., and a displacement of 400 tons. Her engines have a collective nominal power of 120-horse, and drive two 3-bladed screws, each independently of the other, 7ft. in diameter, and with a pitch of 14 ft. 6 in. The cylinders have a diameter of 26 in., and a 21 in. stroke. She carries two short masts, rigged for fore and aft canvas. Her draught of water at starting was 7 ft. 3 in. aft, and 5 ft. 3 in. forward.

A large party of gentlemen left town on Tuesday morning by the 10 52 train from Fenchurch-street for Tilbury station pier, alongside which the "Aurora" lay with her steam up. Immediately on the party embarking the screws were set to work in opposite directions, and the vessel slewed round with her head down river and started on her trial at 12 20 p.m., under the charge of Mr. Leigh, Trinity pilot, the wind being strong at S.W., and the tide half-ebb. In running past the measured mile, in the Lower Hope, with the engines not up in their number of revolutions, she was timed and found to go over the ground in 4 min. 8 sec., giving the vessel a speed of 14·516 knots. At 1 30 p.m. the "Aurora" was approaching the Nore-light vessel, the engines averaging 120 revolutions, with 27 lb. of steam and a vacuum of 25 in., and every part working with the greatest possible smoothness. At 1 37 the Nore was passed, the distance from Tilbury, 20 nautical miles, having been done in 1 hour and 17 minutes, an almost unparalleled rate of speed, considering the vessel's horse-power of engine and hull displacement. From the Nore to the Mouse Light the vessel continued her course, the wind still fresh from the same quarter, and the movement of the water which necessarily accompanied it giving the vessel, from her light draught and hold upon the water, sufficient "roll" to detract from the efficient acting of her only just submerged screws. Notwithstanding this disadvantage, however, she ran past the "mile" on the Maplin Sands in 4 min. 10 sec., giving a speed of 14·400 knots, it being now about slack water, and the tide of little moment either way, and accomplished the distance to the Mouse-light at 2h. 5m. 22s., having been 28 min. and 23 sec. from the Nore—8 nautical miles. During the latter part of the run down a small jib had been set to steady the vessel, but no other help was given by the vessel's canvas to her engines in attaining this somewhat extraordinary rate of speed. From the Mouse the "Aurora" was run out between the Maplin and the Barrow, as far as the Swin-light, passing the "James Dixon," a fine screw collier under sail and full steam, with her head in the same direction as the "Aurora's," on the way. On reaching the Swin the vessel's head was brought round and laid homeward, it having been decided not to lengthen the trial by making circles, &c., owing to the high state of the wind, the light condition of the vessel, and the very satisfactory manner in which she had already turned both to port and starboard in answer to her rudder or screws, proving that she possessed the same facilities in that respect as were possessed by the "Flora," "Hebe," and "Kate"—a facility of manœuvring, in fact, which must necessarily be possessed by every vessel built for and fitted with double screws driven by independent engines. Southend was passed at 4h. 15m., and about two miles ahead was seen the "Sea Swallow," one of the fastest paddle steamers on the Thames, plying between London, Southend, and Sheerness, and a hot chase naturally ensued, the "Aurora" eventually passing the clipper at 4h. 40m. in the midst of a heavy squall of wind and rain, and subsequently during the run up to Blackwall passing everything under steam she came across. Gravesend was passed at 5h. 15m., the engines making on the average at the time 127 revolutions, and Blackwall pier, the closing point of the "Aurora's" day's work, being reached in 1h. 7m., the distance being 20 miles. At Blackwall the numerous visitors on board disembarked and returned to town by rail.

HENLEY'S INDIAN TELEGRAPH.

The *Times* states that the shipment of the Indian telegraph cable from Mr. Henley's factory at North Woolwich is now in active operation. The "Marian Moore," carrying 170 miles of the cable, left the Downs a few days ago for Bombay, and is expected to arrive at her destination towards

the end of November. The sailing ships "Assaye" and "Kirkham," moored alongside the works, are now receiving their cargoes of the wire, which is being rapidly coiled in the holds of both ships simultaneously by steam machinery constantly at work. The former vessel will carry about 360 miles, and the latter about 200 miles. The "Assaye" is well known at Woolwich, where she arrived last year in company with the sister ship, the "Punjab," at that time both paddle-wheel steamers. They were removed from Woolwich to the Victoria Docks, and were sold to a Liverpool firm, since which time they have both been ship-rigged and converted into sailing ships. Both are exceedingly fast sailers, and what is termed "clipper ships." Although fitted with powerful engines they performed the voyage under sail, at the rate (it is stated) of upwards of 16 knots per hour, and made the voyage home in 75 days. They are both constructed throughout of teakwood. The "Kirkham" is an iron vessel, paintedwhite. The cable is coiled in largewater-tight tanks, three on board each ship, which will be kept full of water throughout the voyage to Bombay. They are expected to sail from Woolwich the second week in September, and will be fully equipped with all appliances for paying out the cable at sea. The "Tweed" (late the "Punjab") and the "Cospatrick" will follow the two vessels, now alongside, and will take in 350 miles and 200 miles respectively. The latter-named ships are being fitted at Poplar by Messrs. Wigram for the reception of the cable, under the superintendence of Captain Dicey. The "Charente," a screw steamer of about 600 tons, is being fitted by the above-named firm for permanent employment on the line, and will be supplied with all requisites for repairing the cable, should any accident arise hereafter from ships' anchors, or any casualties to which the wire must be subjected by exposure. The "Charente" will take out a small quantity of cable in addition to her coals. She will be commanded by Lieutenant Stiffe, an experienced officer of the Indian Navy, who has recently surveyed the Persian Gulf specially with regard to this important undertaking. The total length of cable taken out for this line will amount to 1,250 miles, and will weigh upwards of 5,000 tons, being an excess of 2,000 tons over that of the Red Sea, Malta, and Alexandria, or the Atlantic. The wire alone of the present cable weighs 1,000 tons. The operations, which are under the direction of Lieutenant-Colonel Stewart, Royal Engineers, are expected to be completed by the month of February next, when it is hoped that London and Calcutta will be in telegraphic communication, by which a correspondence may be conveyed from one hemisphere to the other in the course of a very few hours. Sir Charles Bright and Mr. Latimer Clark, the consulting engineers, superintending the manufacture of the cable, are attended by a competent and effective staff of electricians at Woolwich, who supervise and test the whole of the work as it progresses. The "Gammelholm," a Danish storeship, arrived and moored off Mr. Henley's works at Woolwich on Saturday morning, preparatory to taking in a telegraphic cable for the Danish Government, which will weigh upwards of 15 tons per mile. Twenty-five miles of the electric wire have also been recently despatched from the same factory to Christiana for the Norwegian Government.

MIDLAND BOILER INSPECTION AND ASSURANCE COMPANY.

THE Engineer's report to the members of this Association at their last meeting, held at Wolverhampton, stated "that during the half-year ending June 30 last, particulars were obtained of 371 boilers, with a view to proposal for inspection of assurance, which, with those before reported, made a total of 2,616. Proposals had been accepted during the six months for the inspection of 215, and the assurance of 134, making together 349 boilers. The total number of boilers under inspection up to June 30 was 619, and under assurance 500, making 1,119 boilers under the care of the company. That number had now been increased to 1,184. The boilers were of the following descriptions:—Plain cylindrical (externally fired), 670; furnace boilers, of various shapes, 235; Cornish or others (internally fired), 126; low-pressure balloon, or waggon-shaped, 88; total, 1,119. These boilers were employed as follows:—Colliery engines, for pumping, 95; ditto, for winding, 234; mills and forges, 123; blast furnaces, 171; canals, water, and gasworks, 43; lathe engines, 22; clay mills, 22; saw mills, 7; rope-walks, 4; flour mills, 3; locomotive, 2; stamping, 3; total, 1,119. All boilers had been subjected to the same careful inspection, and whenever opportunity could be given, they had been examined internally and in the flues. There had been made during the half-year 1,986 external, 163 internal, and 337 thorough—in all 2,486 examinations, and both masters and engine tenters had given every facility for those examinations. Fifty-five reports had been sent to owners as to matters requiring attention, and the recommendations had been speedily carried out. Care had been taken to avoid causing needless trouble or expense. The chief points reported on had been as follows:—Alteration of shape from the insufficiency or want of proper stays, or from undue heating, or careless usage, or from injury by accumulation of scurf or blistering of plates. The strength of the shells of boilers was frequently found greatly diminished by inefficient repair, especially from the use of little narrow patches over cracks on the edges of plates, which might effectually prevent leaking for a time, but which leaves the plate little, if any, stronger than it would be with the crack untouched. Many of these patches have been found on a single plate, and they seldom lasted long, as they burnt off because the water could not reach them. Safety valves are very frequently found over-weighted, either from inadvertence or to prevent leaking when the valve requires "scouring." These valves are of little use unless they are so adjusted as to lift freely at a few pounds above the ordinary working pressure, so as to give complete relief before the pressure can rise to an unsafe height. Much danger would be avoided if the practice were more common of having a valve near each engine of sufficient size to let off as much steam as the engine usually takes, and within easy access of the man in charge to open where there is a "stand." Safety valves are also sometimes over-weighted to make an engine that is out of repair do its required work. Attention having been called to this point in reports, has led to engines being worked with considerably less pressure of steam, thereby effecting great economy. Pressure gauges of all kinds are frequently found out of order and indicating falsely; but this is more often from unfair usage than from defect in their principle or construction. All gauges should be as near as possible to the boilers, so as to indicate the pressure at which the steam is "raised," not that at which it is used. A good gauge, kept in perfect repair, frequently applied to each boiler at taps placed for that purpose, and the safety valves adjusted by it, would often be a greater safeguard than gauges left constantly in exposed positions. Glass gauge tubes can seldom be kept in order in ironworks, as they are so much exposed to breakage. Floats are almost universal, many boilers being fitted with two, but they are too frequently found working badly. Scurf is found in almost all boilers in this district, varying in thickness and composition. Scurf is only of consequence on those parts of the boilers exposed to heat; needless injury to plates and rivets is frequently caused by too vigorously chipping to get it off. The plates near the fire cannot be kept too carefully cleaned. Blow pipes would very much mitigate the evils of scurfing if they were more frequently used, especially in plain cylinder boilers, and those with fire under them. Corrosion is seldom met with on the inside of boilers in this district, but it is a most frequent cause of injury on the outside, from the leaking of the steam pipes and fittings. Thinning of plates from this cause has been most frequently reported, both above and beneath the brickwork, and in many cases to a dangerous extent. In all reports attention was called to anything that was observed likely to lead to injury or expense, as well as to anything causing present danger. There have been twenty-one explosions in various parts of the country since the beginning of 1863.

ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

AT the last monthly meeting of the Executive Committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday—Mr. W. Fairbairn, C.E., F.R.S., in the chair—Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—"During the past month there have been examined 313 engines and 401 boilers. Of the latter, 6 have been examined specially, 9 internally, 45 thoroughly, and 341 externally, in addition to which two of these boilers have been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture, 5 (1 dangerous); corrosion, 14; safety valves out of order, 7; water gauges ditto, 9 (1 dangerous); pressure gauges ditto, 15; feed apparatus ditto, 2; blow-out apparatus ditto, 27; fusible plugs ditto, 1; furnaces out of shape, 4 (1 dangerous); over-pressure, 3; deficiency of water, 1 (dangerous). Total, 88 (4 dangerous). Boilers without glass water gauges, 3; without blow-out apparatus, 16; without back pressure valves, 25. Nine explosions have occurred during the past month, from which 5 persons have been killed and 3 others injured. Not one of the boilers in question was under the inspection of this Association. A personal examination of three of these has been made subsequently to the explosion, while in the remaining cases this was prevented by distance. In one case the cause of the explosion was simply the dilapidated condition of the boiler; it had repeatedly been found to leak at the back end, both at the last plate at the bottom, as well as at the flat end one, and had, in consequence, been temporarily repaired, from time to time, with bolted patches. Patches, when necessary, should always be rivetted on, no reliance can be placed upon those merely bolted. At the time of the explosion there were three of these patches on the boiler, within 12in. of one another. The surrounding plate at length became so eaten away by continual leakage, that it was reduced in places to one-eighth of an inch in thickness, and in others to that of a sheet of brown paper, from which rupture ensued, underneath the boiler, at the back end, immediately over the mid-feather; the mid-feather, no doubt, accelerating the corrosion, by ponding the water, and holding it in contact with the plate, at the same time that it concealed the full extent of the injury. Competent inspection could not have failed to detect the dangerous condition of the boiler." The report concludes with suggestions as to the best mode of setting boilers.

SUBSTANCES FOR PREVENTING AND REMOVING BOILER INCRUSTATIONS.

THE following is a list of substances which have been used, with more or less success, in preventing and removing the incrustations which are formed by using hard water in boilers:—

Potatoes.—By using about one-fiftieth of potatoes to the weight of water in a boiler, scale will be prevented, but not removed. Their action is mechanical; they coat the calcareous particles in the water, and prevent them from adhering to the metal.

Extract of Tannin.—A mixture has been used of 12 parts chloride of sodium, 2½ parts caustic soda, ¼ extract of oak bark, ⅛ of potashes, for the boilers of stationary and locomotive engines. The principal agent in this appears to be the tannin of the extract of oak bark.

Pieces of Oak Wood, suspended in the boiler and renewed monthly, prevent all deposit, even from waters containing a large quantity of lime. The action depends principally upon the tannic acid.

Ammonia.—The muriate of ammonia softens old incrustations. Its action is chemical; it decomposes the scale. In Holland it has been used with satisfaction in the boilers of locomotives. About 2 ounces placed in a boiler twice per week have kept it clean, without attacking the metal.

Fatty Oils.—It is stated that oils and tallow in a boiler prevent incrustations. A mixture, composed of 3 parts of blacklead and 18 parts tallow, applied hot, in coating the interior of a boiler, has given great satisfaction in preventing scale. It should be applied every few weeks.

Molasses.—About 13 lb. of molasses, fed occasionally into a boiler of 8-horse power, have served to prevent incrustations for six months.

Sawdust.—Mahogany and oak sawdust have been used to prevent and remove scale; but care must be exercised not to allow it to choke up pipes leading to and from the boiler. Catechu contains tannic acid, and has also been used satisfactorily for boilers. A very small amount of free tannic acid will attack the iron; therefore a very limited quantity of these substances should be employed.

Slippery Elm Bark.—This substance has also been used with some success in preventing and removing incrustations.

Soda.—The carbonate of soda has been recommended by Professors Kuhlman and Fresenius, of Germany, and Crace Calvert, of England. It is now employed with satisfaction in the boilers of engines in Manchester.

Tin Salt.—The chloride of tin is equal to the muriate of ammonia; and is similar in its action in preventing scale.

The *Extract of Tobacco* and *Spent Tanners' Bark* have been employed with some degree of satisfaction. The sulphate (not the carbonate) of lime is the chief agent in forming incrustations. By frequent blowing off, incrustations from carbonate of lime in water will be in a great measure prevented.

TANNAHILL'S IMPROVEMENTS IN RIVET-MAKING MACHINERY.

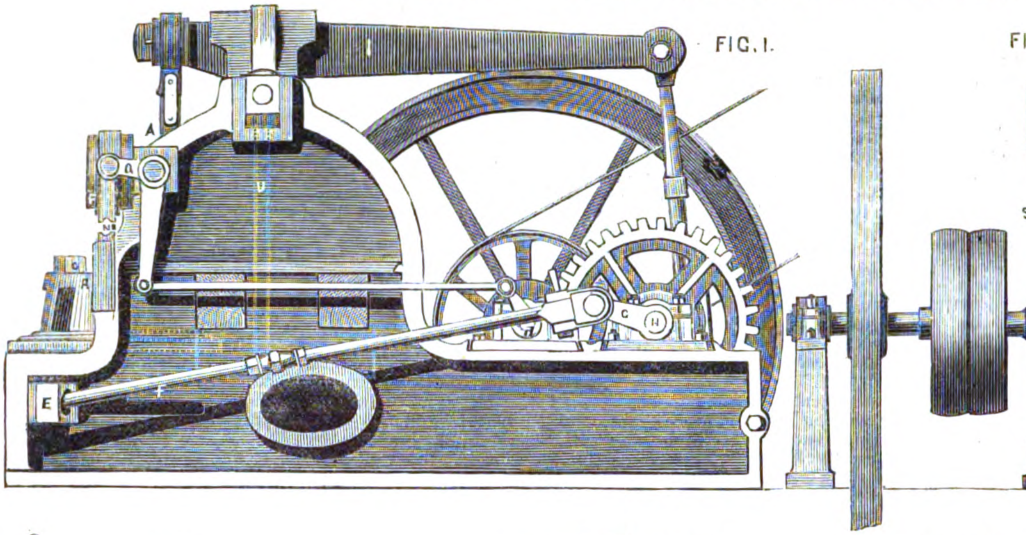


FIG. 1.

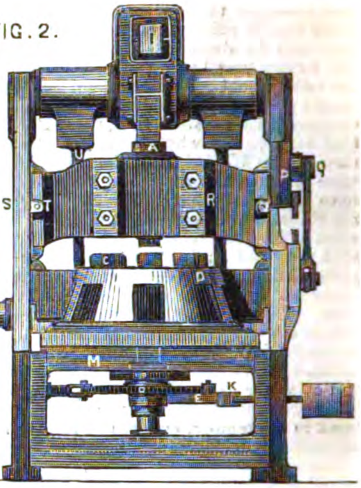


FIG. 2.

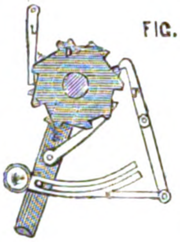


FIG. 4.

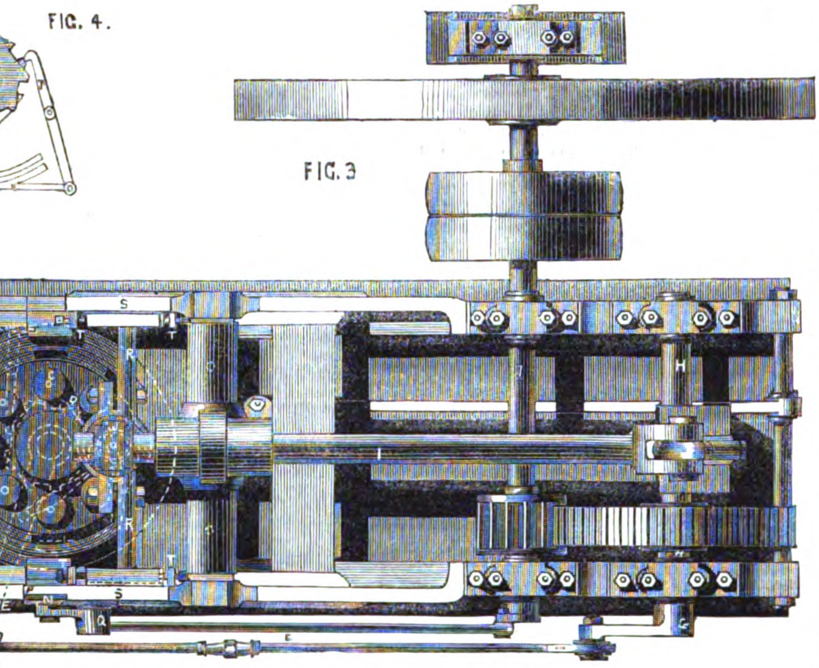


FIG. 3

D. AND J. TANNAHILL'S IMPROVEMENTS IN RIVET-MAKING MACHINERY.

THE following improvements in rivet-making machinery have been patented by Messrs. D. and J. Tannahill, engineers, of Glasgow :—

This invention relates to improvements which are more or less applicable to various kinds of rivet-making machinery.

Fig. 1 is a side elevation, fig. 2 is an end elevation, and fig. 3 is a plan, of a rivet-making machine, embodying some of these improvements. This machine is of the class termed "vertical," from the motion of the ram or shaping-head A being vertical, and in some respects it resembles machines of that class as hitherto constructed. It will therefore be unnecessary to give a very detailed description.

The first novelty relates to the turn-table movement, by which the table or disc B, with the series of dies C, is shifted round between each stroke to bring a fresh die under or in front of the ram or shaping-head A. A difficulty has hitherto been experienced in combining with a simple and easy movement the necessary accuracy of position at each shift; by the present invention, however, this is effected by employing a reversed ratchet with the ordinary ratchet and pawl lever arrangement by which the table or disc B is shifted. The reversed ratchets are indicated by dotted lines at D in fig. 3, and are shown detached in fig. 4. The table B is shifted round step by step by the pawl lever E, actuated by means of a connecting rod F from a crank G on the main shaft H, by which the main lever or beam I is worked. A catch J, indicated by dotted lines in fig. 3, is centered on a stationary stud, and is arranged to engage with the reversed ratchet, being pressed inwards by a spring, and a tooth of the ratchet is brought firmly up against it at each shift by the action of the pawl lever E on the other ratchet. At the commencement of each shift the reverse ratchet-catch J is for a moment drawn out of the way for the point of the next ratchet-tooth to pass it. For this purpose the catch J is fitted with a slotted link K, which embraces the pawl lever E or a pin on that lever, and just as it completes its backward movement, the pawl lever E draws over the link K, and thereby causes the catch J to be moved outwards. An ordinary spring pawl L, indicated by dotted lines in fig. 3, is provided to prevent the table B from moving backwards. The ratchet wheels D are, by preference, constructed so that the faces of the teeth are cut out of steel, cavities being formed in the original block to receive the steel in the requisite positions. This improved shifting movement may be applied to either a "vertical" or a "horizontal" machine. When the machine is vertical, and the die-table or disc B turns about a vertical axis, the table B is, by preference, made to rest and turn in a circular V-shaped groove, as indicated at M in fig. 2, instead of being formed with an inverted groove to rest on a projecting ridge. The machine is provided as usual with cutters N for cutting the blanks off the rods; but the upper or moveable cutter is, by preference, made to work rectilineally in guides P, being jointed instead of fixed to the lever Q, by which it is actuated. The bridge piece R, in which the ram or shaping-head A is guided, is accurately fitted into its seats in the side frames S, but so as to permit of accurate adjustment at any time by means of set screws T, screwed into lugs provided on opposite sides of it for the purpose. In a similar way the rods U, by which the main lever I is held down to the wooden spring beams, are screwed at their lower ends and fitted with nuts, as indicated by dotted lines in fig. 1, so that they can at any time be accurately adjusted.

LÜTHY'S IMPROVEMENTS IN HYDRAULIC PRESSES.

LETTERS PATENT have just been granted to Robert Lüthy, of Solothurn, in the Republic of Switzerland, and of No. 2, Thavies Inn, in the City of London.

The object of this invention is to economize time and labour in the working of hydraulic presses, and also to reduce their weight so as to render them more portable, and thereby facilitating their conveyance to distant parts.

The improvements are applicable to all hydraulic presses, but more especially to such as are intended for packing cotton, wool, hay, and other like materials, and in which the piston has to perform the greater part of the stroke without meeting with much resistance. In the ordinary presses hitherto used for this purpose, the piston or ram is forced through this first part of its stroke simply by forcing the water or other fluid into the cylinder in the usual manner, namely, by means of pumps or accumulators, and at a considerable outlay of time and labour.

Now, the present improvements relate, firstly, to presses in which the piston or ram has to pass through the whole length of the stroke or lift, and consist in raising or moving the ram through the first or principal part of the stroke by means of a screw or screws, or by rack and pinion motion, or by other suitable mechanism; but the patentee prefers to use one or more smaller hydraulic rams for effecting this object.

The said mechanicism or apparatus may be connected with the press piston or larger ram through the press plate commonly called follower, or it may be made to act upon a rod passing through the bottom of the cylinder, and bearing direct upon the ram. In using a small hydraulic

LÜTHY'S IMPROVEMENTS IN HYDRAULIC PRESSES.

FIG. 4.

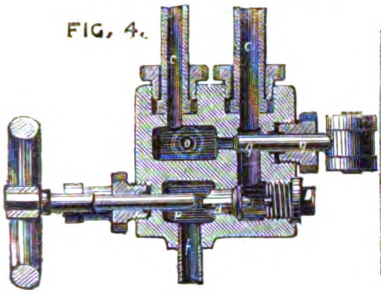


FIG. 1.

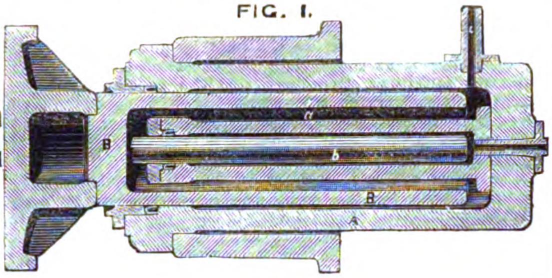


FIG. 2

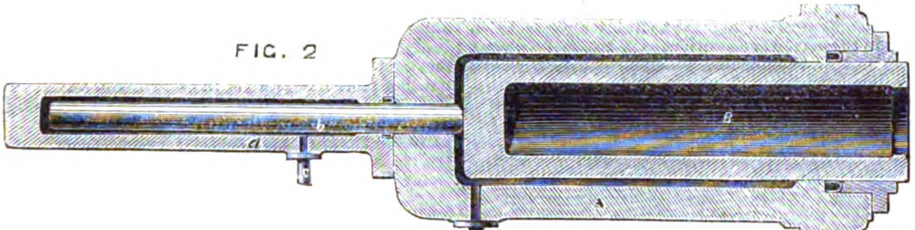
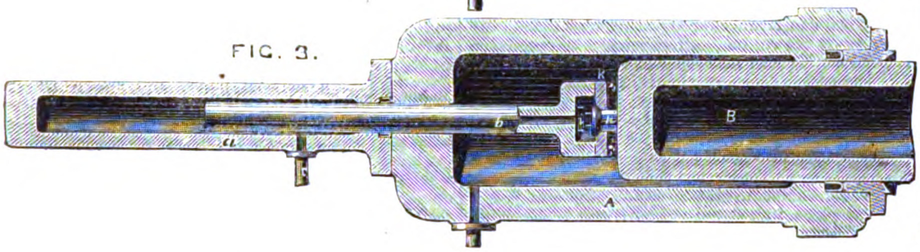


FIG. 3.



ram and cylinder, however, it is proposed to place the same either outside the large cylinder, the small ram passing through the bottom of the latter, or inside the same, and partly inside the larger ram, so that the small ram acts directly upon the large one, and moves the same through the first part of the stroke, the pressure from the pump or accumulator being at the same time communicated to the fluid in the small cylinder only. During this part of the stroke the large cylinder is filled with water or other fluid supplied from the pump, cistern, or other reservoir. When the resistance of the material under pressure is equal to the pressure of the small ram the supply from the reservoir to the large cylinder is shut off, and the pressure from the pump or accumulator is communicated to the large ram, which will then complete the stroke, and give the final pressure. The small ram may be stationary during this last part of the stroke, and consequently so much shorter, or it may move with the large ram through the whole stroke. The admission of the supply to the large cylinder, and the communication of pressure to the ram may be effected by working cocks or valves by hand; or by the use of a self-acting apparatus connected with all the pipes leading to the cylinders, pumps, or accumulator and supply reservoir. This apparatus consists of suction valve for the supply of the large cylinder during the first part of the stroke of a valve weighted according to the pressure of the pumps or accumulator, which will open and communicate pressure to the large cylinder, when the small ram meets with a resistance equal to its pressure, and of an arrangement for disengaging the cylinders either by common stop-cocks, or by opening the suction valve to disengage the large cylinder.

To communicate the pressure to the large cylinder the ram is made hollow and fitted with a valve bearing against the large ram, which valve will open when the resistance is equal to the pressure on the valve. This arrangement may also be used as a self-acting apparatus in connection with the pipes leading to the cylinders in- [illegible] being part of the rams. The small ram [illegible] hollow, with apertures through its sides to communicate the pressure to the large ram at the end of the first part of the stroke.

Secondly, these improvements relate to those hydraulic presses in which the stroke of the larger ram may be shorter than the lift required for the whole operation. For this purpose the first part of the stroke is effected by means of a cylinder and ram of the requisite length, but small diameter, and therefore of comparatively small weight The large cylinder and its ram, which may rest on the small ram, are made of the length necessary for giving the final pressure. In this case the, fluid is forced into the small cylinder, and when its ram has completed the first part of the stroke, the fluid passes into the large cylinder through a cock or valve forming part of either cylinder or ram, or it may pass through extra pipes to the large cylinder.

Thirdly, these improvements relate to apparatus for supporting the platform or follower, or the cylinder and rams upon which the material to be compressed rests—for instance, when the small ram has completed its stroke. These apparatus consist, again, in small hydraulic cylinders, into which the fluid is allowed to enter, whilst their rams attached to the follower rise through the first part of the stroke. When the rams are not in motion the suction valves will close and prevent the escape of the fluid, which will now support the pressure or weight resting upon them.

Figs. 1, 2, and 3 represents parts of these hydraulic presses in section. Fig. 1 shows an arrangement with the small cylinder placed within the larger one; figs. 2 and 3 represent the small cylinder placed outside the larger one.

A represents the large cylinder; B, the large ram; *a*, the small cylinder; *b*, the small ram; C, the supply pipe for the larger cylinder; *c*, the pipe for the smaller cylinder. Fig. 4 represents, in section, and on a larger scale, a self-acting apparatus through which the fluid from the pumps or accumulator and the reservoir has to pass to reach the cylinders.

In working presses, constructed as shown in figs. 1 and 2, and provided with a self-acting apparatus, as shown in fig. 4, the water, oil, or other fluid is forced by the pumps or accumulator into the self-acting apparatus at *o*, fig. 4, and from there direct through the pipe *c* into the smaller cylinder *a*, the ram *b* of which being against the larger ram B, will move the same till the resistance of the material to be compressed is equal to the force of the small ram *b*. During this part of the stroke the space vacated by the larger ram B is filled up with fluid which enters the cylinder A from a supply reservoir through the pipe *f*, the suction valve *d*, and the pipe *c*, fig. 4.

When the rams have arrived at the end of the first part of the stroke, the fluid under pressure will open the valve *g*, which is weighted accordingly by a spring or weights; the fluid is thus forced through the pipe C into the large cylinder A, the ram B of which will then complete its stroke, and give the final pressure. The fluid is after each operation led back from the cylinders to the pump and supply cistern by opening common stop-cocks, not shown in the drawings; or in order to empty the large cylinder more speedily, the valve *d* may be opened by a screw *p*, as shown in fig. 4, or by any other suitable arrangement.

A press arranged as shown in fig. 3 works in the following manner:—The fluid enters the small cylinder *a* through the pipe *c*; the ram *b* is hollow, and is fitted at the top with a valve *h* bearing against the larger ram B; the valve *h* is pressed slightly against its seating fixed to the top of the small ram *b* by a spring *i*, in order to hold it in its position. The area of this valve *h* is a little smaller than the area of the ram *b*, which will cause the seating *k* to separate from the valve *h* as soon as the resistance of the large ram B or the valve is equal to the pressure of the fluid on the other side of the valve. The large cylinder A, which was supplied during this part of the stroke with the fluid from the reservoir D, through the suction valve *d*, is now open to the action of the pumps, or the accumulator, and the ram B will give the final pressure.

THE BRITISH ASSOCIATION.

Abstract of Inaugural Address of Sir William Armstrong.

The proceedings of the annual meeting of the British Association, held this year at Newcastle-on-Tyne, were commenced on Wednesday evening. A meeting of the members and associates was held at the Town-hall, at which the President for the year, Sir William Armstrong, delivered the inaugural address of which the following is an abstract of portions.

The President commenced by saying that he esteemed it the greatest honour of his life that he was called upon to assume the office of President. In that capacity, and as representing the Association, he must be allowed to advert to the gratifying reception which the British Association met with on their former visit to this region of mining and manufacturing industry; and, as a member of the community which they had again honoured with a visit, he undertook to convey to them the assurance of a renewed and hearty welcome. A quarter of a century had elapsed since the Association assembled in this town, and in no former period of equal duration had so great a progress been made in physical knowledge. In mechanical science, and especially in those branches of it which are concerned in the application of steam power to effect interchange between distant communities, the progress made since 1838 had no parallel in history. The railway system was then in its infancy, and the great problem of trans-Atlantic steam navigation had only received its complete solution in the preceding year. Since that time railways have extended to every continent, and steamships have covered the ocean.

It was chiefly in this locality that the railway system was reared from earliest infancy to full maturity; and amongst the many names associated wit its growth, that of George Stephenson stands preeminent.

In glancing at the history of railways, we may observe how promptly the inventive faculty of man supplies the device which the circumstances of the moment require. No sooner is a road formed fit for wheeled carriages to pass along, than the cart takes the place of the pack-saddle; no sooner is the wooden railway provided, than the waggon is substituted for the cart; and no sooner is an iron railway formed, capable of carrying heavy loads, than the

locomotive engine is found ready to commence its career. As in the vegetable kingdom fit conditions of soil and climate quickly cause the appearance of suitable plants, so in the intellectual world fitness of time and circumstance promptly calls forth appropriate devices. The seeds of invention exist, as it were, in the air, ready to germinate whenever suitable conditions arise, and no legislative interference is needed to ensure their growth in proper season.

To persons who contend that all geological phenomena may be attributed to causes identical in nature and degree with those now in operation, the formation of coal must present peculiar difficulty. The rankness of vegetation which must have existed in the carboniferous era, and the uniformity of climate which appears to have prevailed almost from the Poles to the Equator, would seem to imply a higher temperature of the earth's crust, and an atmosphere more laden with humidity and carbonic acid than exist in our day. But whatever may have been the geological conditions affecting the origin of coal, we may regard the deposits of that mineral as vast magazines of power stored up at periods immeasurably distant for our use.

The principle of conservation of force and the relationship now established between heat and motion, enable us to trace back the effects which we now derive from coal to equivalent agencies exercised at the periods of its formation. The philosophical mind of George Stephenson, unaided by theoretical knowledge, rightly saw that coal was the embodiment of power originally derived from the sun. That small pencil of solar radiation which is arrested by our planet, and which constitutes less than the 2,000-millionth part of the total energy sent forth from the sun, must be regarded as the power which enabled the plants of the carboniferous period to wrest the carbon they required from the oxygen with which it was combined, and eventually to deposit it as the solid material of coal. In our day the reunion of that carbon with oxygen restores the energy expended in the former process, and thus we are enabled to utilize the power originally derived from the luminous centre of our planetary system.

But the agency of the sun in originating coal does not stop at this point. In every period of geological history the waters of the ocean have been lifted by the action of the sun and precipitated in rain upon the earth. This has given rise to all those sedimentary actions by which mineral substances have been collected at particular localities, and there deposited in a stratified form with a protecting cover to preserve them for future use. The phase of the earth's existence suitable for the extensive formation of coal appears to have passed away for ever; but the quantity of that invaluable mineral which has been stored up throughout the globe for our benefit is sufficient (if used discreetly) to serve the purposes of the human race for many thousands of years. In fact, the entire quantity of coal may be considered as practically inexhaustible. Turning, however, to our own particular country, and contemplating the rate at which we are expending those seams of coal which yeild the best quality of fuel, and can be worked at the least expense, we shall find much cause for anxiety. The greatness of England much depends upon the superiority of her coal in cheapness and quality over that of other nations; but we have already drawn from our choicest mines a far larger quantity of coal than has been raised in all other parts of the world put together, and the time is not remote when we shall have to encounter the disadvantages of increased cost of working and diminished value of produce.

After dwelling at some length on the estimated duration of the English coal-fields, Sir William Armstrong went on to say—Were we reaping the full advantage of all the coal we burnt, no objection could be made to the largeness of the quantity; but we are using it wastefully and extravagantly in all its applications. It is probable that fully one-fourth of the entire quantity of coal raised from our mines is used in the production of heat for motive power; but, much as we are in the habit of admiring the powers of the steam-engine, our present knowledge of the mechanical energy of heat shows that we realize in that engine only a small part of the thermic effect of the fuel. That a pound of coal should, in our best engines, produce an effect equal to raising a weight of a million pounds a foot high is a result which bears the character of the marvellous, and seems to defy all further improvement. Yet the investigations of recent years have demonstrated the fact that the mechanical energy resident in a pound of coal, and liberated by its combustion, is capable of raising to the same height ten times that weight. But although the power of our most economical steam-engines has reached, or perhaps somewhat exceeded, the limit of a million pounds raised a foot high per lb. of coal, yet, if we take the average effect obtained from steam-engines of the various constructions now in use, we shall not be justified in assuming it at more than one-third of that amount. It follows, therefore, that the average quantity of coal which we expend in realizing a given effect by means of the steam-engine is about thirty times greater than would be requisite with an absolutely perfect heat-engine.

The causes which render the application of heat so uneconomic in the steam-engine have been brought to light by the discovery of the dynamical theory of heat; and it now remains for mechanicians, guided by the light they have thus received, to devise improved practical methods of converting the heat of combustion into available power.

Engines in which the motive power is excited by the communication of heat to fluids already existing in the aeriform condition, as in those of Stirling, Ericsson, and Siemens, promise to afford results greatly superior to those obtained from the steam-engine. They are all based upon the principle of employing fuel to generate sensible heat, to the exclusion of latent heat, which is only another name for heat which has taken the form of unprofitable motion amongst the particles of the fluid to which it is applied. They also embrace what is called the regenerative principle—a term which has, with reason, been objected to, as implying a restoration of expended heat. The so-called "regenerator" is a contrivance for arresting unutilized heat rejected by the engine, and causing it to operate in aid and consequent reduction of fuel.

It is a common observation that before coal is exhausted some other motive agent will be discovered to take its place, and electricity is generally cited as the coming power. Electricity, like heat, may be converted into motion, and both theory and practice have demonstrated that its mechanical application does not involve so much waste of power as takes place in a steam-engine; but whether we use heat or electricity as a motive power, we must equally depend upon chemical affinity as the source of supply. The act of uniting to form a chemical product liberates an energy which assumes the form of heat or electricity, from either of which states it is convertible into mechanical effect. In contemplating, therefore, the application of electricity as a motive power, we must bear in mind that we shall still require to effect chemical combinations, and in so doing to consume materials. But where are we to find materials so economical for this purpose as the coal we derive from the earth and the oxygen we obtain from the air? The latter costs absolutely nothing; and every pound of coal, which in the act of combustion enters into chemical combination, renders more than two and a half pounds of oxygen available for power. We cannot look to water as a practicable source of oxygen, for there it exists in the combined state, requiring expenditure of chemical energy for its separation from hydrogen. It is in the atmosphere alone that it can be found in that free state in which we require it, and there does not appear to me to be the remotest chance, in an economic point of view, of being able to dispense with the oxygen of the air as a source either of thermo-dynamic or electro-dynamic effect. But, to use this oxygen, we must consume some oxidizable substance, and coal is the cheapest we can procure.

With regard to smoke, which is at once a waste and a nuisance, having himself (the President) taken part with Dr. Richardson and Mr. Longridge in a series of experiments made in that neighbourhood in the year 1857-58, for the purpose of testing the practicability of preventing smoke in the combustion of bituminous coal in steam-engine boilers, he could state with perfect confidence that, so far as the raising of steam is concerned, the production of smoke was unnecessary and inexcusable. The experiments to which he referred proved beyond a doubt that, by an easy method of firing, combined with a due admission of air and a proper arrangement of firegrate, not involving any complexity, the emission of smoke might be perfectly avoided, and that the prevention of the smoke increased the economic value of the fuel and the evaporative power of the boiler. As a rule, there is more smoke evolved from the fires of the steam-engines than from any others, and it is in these fires that it may be most easily prevented. But in the furnaces used for most manufacturing operations, the prevention of smoke is much more difficult, and will probably not be effected until a radical change is made in the system of applying fuel for such operations.

Sir William, after some further remarks on coal, the power of water, Siemen's furnaces, &c., adverted to Mr. Nasmyth's remarkable discovery, that the bright surface of the sun is composed of an aggregation of apparently solid forms, shaped like willow-leaves or some well-known forms of Diatomaceæ, and interlacing one another in every direction. The forms are so regular in size and shape as to have led to a suggestion from one of our profoundest philosophers of their being organisms, possibly even partaking of the nature of life, but at all events closely connected with the heating and vivifying influences of the sun. These mysterious objects, which, since Mr. Nasmyth discovered them, have been seen by other observers as well, are computed to be each not less than 1,000 miles in length and about 100 miles in breadth. The enormous chasms in the sun's photosphere, to which we apply the diminutive term "spots," exhibit the extremities of these leaf-like bodies pointing inwards, and fringing the sides of the cavern far down into the abyss. Sometimes they form a sort of rope or bridge across the chasm, and appear to adhere to one another by lateral attraction. He could imagine nothing more deserving of the scrutiny of observers than these extraordinary forms. The sympathy, also, which appears to exist between forces operating in the sun and magnetic forces belonging to the earth, merits a continuance of that close attention which it has already received from the British Association, and of labours such as General Sabine has with so much ability and effect devoted to the elucidation of the subject. He then noticed that most remarkable phenomenon which was seen by independent observers at two different places on the 1st of September, 1859. A sudden outburst of light, far exceeding the brightness of the sun's surface, was seen to take place, and sweep like a drifting cloud over a portion of the solar face. This was attended with magnetic disturbances of unusual intensity, and with exhibitions of aurora of extraordinary brilliancy. The identical instant at which the effusion of light was observed was recorded by an abrupt and strongly-marked deflection in the self-registering instruments at Kew. The phenomenon as seen was probably only part of what actually took place, for the magnetic storm in the midst of which it occurred commenced before and continued after the event.

In referring to the science of gunnery, to which he made but slight allusion on this occasion, he stated that it was intimately connected with the dynamical theory of heat. When gunpowder is exploded in a cannon, the immediate effect of the affinities by which the materials of the powder are caused to enter into new combinations, is to liberate a force which first appears as heat, and then takes the form of mechanical power communicated in part to the shot and in part to the products of explosion which are also propelled from the gun. The mechanical force of the shot is reconverted into heat when the motion is arrested by striking an object, and this heat is divided between the shot and the object struck, in the proportion of the work done or damage inflicted upon each. These considerations recently led him, in conjunction with his friend, Captain Noble, to determine experimentally, by the heat elicited in the shot, the loss of the effect due to its crushing when fired against iron plates. Joule's law, and the known velocity of the shot, enabled us to compute the number of dynamical units of heat representing the whole mechanical power in the projectile, and by ascertaining the number of units developed in it by impact, we arrived at the power which took effect upon the shot instead of the plate. These experiments showed an enormous absorption of power to be caused by the yielding nature of the materials of which projectiles are usually formed; but further experiments are required to complete the inquiry.

Whilst speaking of the subject of gunnery, Sir W. Armstrong paid a passing tribute of praise to that beautiful instrument invented and perfected by Major Navez, of the Belgian Artillery, for determining, by means of electro-magnetism, the velocity of projectiles. This instrument has been of great value in recent investigations, and there are questions affecting projectiles which we can only hope to solve by its assistance. Experiments are still required to clear up several apparently anomalous effects in gunnery, and to determine the conditions most conducive to efficiency both as regards attack and defence.

After alluding to Professor Tyndal's researches on heat, the balloon explorations of Mr. Glaisher, the electric telegraph, the metric system, Darwin's theory, &c., Sir William Armstrong concluded his address by saying, "I will not run the risk of wearying this assembly by extending my remarks to other branches of science. In conclusion, I will

press a hope that when the time again comes round to receive the British Association in this town, its members will find the intervals to have been as fruitful as the corresponding period on which we now look back. The tendency of progress is to quicken progress, because every acquisition in science is so much vantage-ground for fresh attainment. We may expect, therefore, to increase our speed as we struggle forward; but however high we climb in the pursuit of knowledge, we shall still see heights above us, and the more we extend our view, the more conscious we shall be of the immensity which lies beyond."

SCIENTIFIC SOCIETIES.

Meeting in the Ensuing Week.—London Association of Foremen Engineers, Saturday the 5th prox., at 8 p. m. Paper to be read by Mr. Gettcliffe on "An Apparatus for Preventing Boiler Explosions."

TO CORRESPONDENTS.

Received.—D. S. F.—W. M. R.—T. M.—T. W. and Co.—C. B. L.

C. (Belfast).—We cannot advise you.

T. Swan (Tring)—Patented three or four times over.

A Pewterer (Birmingham).—You cannot. The French Government prohibits the employment of more than 18 per cent. of lead in the manufacture of pewter.

Gozzan.—Try one of Bastier's chain-pumps. It has been used very successfully to drain shallow mines.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

SPEED FOR THE NAVY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In your number for August 7th you inserted a very well written letter from Capt. Halsted, in which the writer attempts to show that our ships of war should be completely armoured from stem to stern. I think, however, that it is now pretty certain that we cannot get a high speed out of a completely armoured ship, unless the size is increasad to an inconvenient extent; and I think also that the "Alabama" has proved conclusively that speed is a far more important element in the qualities of a man-of-war that even partial invulnerability.

Let the fighting portion of a ship be as invulnerable as possible, with 5 in. iron bulk-heads fore and aft, and make it large enough to contain everything you require for a long voyage and for attack and defence; so far, well; but why cannot a long bow and fine run be added to this fighting portion *merely for speed?* Put nothing at all, if you like, in these parts of the vessel but a foremast and mizenmast; and then why should they be loaded with 4½ or 5 in. plates? Without them she may be made to steam 20 miles an hour, but not with them. Capt. Halsted says that these portions of a ship would form the *targets* for the enemy to fire at! I can only say that if he was foolish enough to waste his ammunition in that way, I think the other Captain would be trying to touch him in a more vital part; and if I were on board I should be tempted to add a broomstick to the bowsprit to tempt him to waste his ammunition on *that*, because it is not covered with armour.

There are ships in the Navy that would be greatly improved in speed by adding a false bow to them, but may not this be added without armour plates being hung upon it?

When ships were 200 ft. long their broadsides were considered amply sufficient, yet when their lengths were increased, it seems to have been considered essential to have guns from stem to stern of the increased broadside; but if the builders had retained the old broadside for guns, and allowed the increased length to be merely for speed, the ships would have been better sea-boats and faster sailers.

If we were at war with another Power, and all our ships of war were constructed according to Capt. Halsted's notions, the enemy would only have to fit up a few "Alabamas" in order to commit depredations upon our mercantile marine, and while our ships would be always ready to fight, they could never be able to get to the spot where fighting is useful—alongside the enemy.

I see no reason why our ships of war should not be the fastest vessels afloat, under steam, as they once were under sail, and not another vessel ought to be built which cannot steam 20 miles an hour; and for this purpose, light and fine ends and light engines with high pressure steam are absolutely necessary.

I am, Sir,
Your very obedient servant,
Clifford's Inn. T. Moy.

TORPEDOES.

Sir,—I have read with great pleasure your leader of yesterday. Upon the necessity of high speed in war vessels we quite agree; but high speed, with weighty armaments and equipments, is hardly attainable.

I have refrained, of late, to address you upon the subject of the employment of submarine explosive shells in naval warfare. My thoughts have not, however, been diverted from that important matter; and I remain in the *confident* belief I have entertained over a period of eighteen years, that vessels armed with cannon cannot successfully combat, on the ocean, with vessels armed with submarine explosive shells; presuming such vessels to be adapted to the service of the arm.

From the accounts I have read of the American torpedoes, I do not think the Americans understand the subject. I could, perhaps, enlighten the Confederates to an extent that would enable them to free themselves of the annoyance of the blockade of their ports, but that would be acting in a manner at variance with the Queen's proclamation of neutrality which her subjects *ought* to respect, especially those who are servants of the Crown.

When, however, the war shall have terminated between the Federals and Confederates—or should it take a turn that it may be legal to aid the State that has no *aggressive* intention, but simply a desire to defend its shores and commerce—there will be no objection to render such State a service that, I doubt not, will be gladly accepted.

With regard to our interest, England has paid dearly enough for experiments in war engines; and she is now wasting her skill and labour in experiments upon war vessels, which in time of need will, I venture to predict, prove worse than useless. These monsters, constructed and equipped at an outlay of about £200,000 each, and upon which great reliance is being placed, can, I do positively assert, be easily rendered unseaworthy or be destroyed by about £40 worth of explosive composition. In the event of war, they would be in imminent danger, in protecting our commerce, when opposed by submarines; they could not pursue vessels, of comparatively pigmy dimensions, armed with submarine shells, without great risk of either being disabled, by their propellers, rudders, and sternposts being blown away; or of being sunk, or of being blown up by their own powder, should one or more explosive shells take effect under their magazines.

It has been my good fortune to become acquainted with an eminent chemist—John Horsley, F.C.S., Analyst for the County of Gloucester—who has for some years past given his attention to explosive compounds; to him I am indebted for a compound, admirably adapted to the service of submarine explosive shells, two hundred pounds weight of which would, in destructiveness, when applied to, and exploded under, and in *hugging* contact with a vessel's bottom, be, I think, equal to eight hundred pounds weight of the best cannon powder.

In conclusion, since I am confident that I have taken a correct view of the matter, the sooner the authorities to whom our defences are entrusted are brought to a comprehension of it, the better; even if such knowledge be forced upon them by any foreign State that may have but little regard for routine modes of proceeding.

Pardon this interruption, and believe me,

Yours sincerely,
Jn. Harvey.

5, Keynsham Parade, Cheltenham,
August 22, 1863.

P.S.—I have just seen, in this day's *Times*, an account of a torpedo being exploded by a vessel passing up the River St. James. If the statement of such explosion is correct, the torpedo could not, I think, have exploded *under* the vessel's bottom, which it ought to have done, and in *hugging* contact, too. I think it exploded *near* the *side* of the vessel, but not in contact with the side. The lift of 10 ft. may prove to be a *heel* of 10 ft.

MEASURING THE LENGTH OF A CIRCLE BY A STRING.

Sir,—In your number for July 10, p. 496, your correspondent, Mr. Denison, says:—"Measuring the length of a circle by a string is hardly a recognized mathematical operation; but the construction of a circle is."

I agree that string is unmathematical; but I should feel obliged if Mr. Denison would let us see any simple mode of constructing a cycloid—still more a simple mode of measuring its base.

Yours, &c.,
August 26, 1863. R. N.

Miscellanea.

We announce, with regret, the death of William Templeton, a gentleman whose contributions to engineering literature have been generally esteemed. There is scarcely an establishment in England where his "Workshop Companion" is not in daily use; and his other works, though few, have proved extremely useful to the young engineer.

Experiments at Newhaven show that the 110-pounder breech-loading Armstrong guns will only take 12 lb. charges. The guns, therefore, are of too small power for the broadside of ships; and, consequently, at present there is no cannon fit for arming the iron-plated ships.

Mr. Reed's experimental iron-cased sloop "Enterprize," built at Deptford, is now receiving her armour casing, which is bent in Woolwich dockyard and forwarded to the ship, ready to be applied. A couple of the plates, 15 ft. by 14 ft. 9 in. each, have been fitted to the sides, and two others are ready to be forwarded. The whole of the plates will be supplied by Mr. Brown, of Sheffield, who made a large proportion of those used in the "Caledonia."

Mr. Reuter's proposal to erect and maintain a line of telegraphic communication from Cork to Crookhaven and Cape Clear, in order to meet the steamers, and obtain the American mails some hours earlier than at present, has been accepted.

The cylinder of an engine attached to one of the trains of the Metropolitan Railway burst on Sunday afternoon from some unexplained cause, and, although no one was injured, a great deal of inconvenience was experienced by large numbers of would-be passengers at Farringdon-street.

On the 25th of June last, Mr. Mohr observed, at Coblentz, a rainbow completely red. The exterior of the bow was very bright, fading away towards the interior edge. Such a phenomenon is very rare.

A vein of magnetic iron has recently been discovered in Sweden which is probably the richest of all the known sources of natural magnets. This vein which is some feet thick, traverses a mountain formed of minerals more or less magnetic, situate on the left hand of the river Bautusjoki, in latitude 67½ deg., and longitude 39¾ deg. Put in connection with the galvanometer, some of these natural magnets produced a deviation of 10 to 15 deg., and a very short contact sufficed to convert a piece of iron into a magnet capable of sustaining a weight of 1 lb. or 2 lb. Swedish. Natural magnets weighing 400 livres from this vein are easily obtained, their price varying from 80 centimes to 3 francs the kilogramme.

A letter from Constantinople, dated August 20, says:—The statements published by some journals relative to the Suez Canal settlement are erroneous. Forced labour is absolutely abolished, the company having six months allowed them to make other labour arrangements.

A train conveying petroleum recently took fire on the Pennsylvania railroad, and the heat was so intense that the cross ties of the track on which the cars stood, and also of the track adjoining, were burned through, and the rails so warped as to render it difficult for trains to pass. The foliage of the trees was burned off and shrivelled for a distance of 50 ft. on either side of the track.

The "Marian Moore" a transport vessel, has left the Thames, having on board 900 miles of electric telegraph wire, &c., which was shipped at the works of Messrs. Henley, North Woolwich, to be laid down in India.

The Malta and Alexandria telegraph cable is now finally repaired, and messages can now be taken direct from London to Suez to catch the Indian, China, and Australian mails at Suez.

A new traction engine for the prairies is thus described by an American paper:—"An engine, built by John A. Reed, an eminent and skilful inventor, arrived in Nebraska City a year ago. It will draw eight tons of freight up a grade of 600 ft. to the mile, nearly twice as steep as the heaviest railroad

grade. The tread wheels are ridged to prevent slipping. This machine, being the first one built, is propelled by four engines of ten horse-horse power each. The cylinders are oscillating, and connect with shafts, upon which are pinions of 12 in. diameter, which move upon and give motion to wheels, about 6 ft. in diameter, which are attached to the inside of the spokes of the driving wheels. The drivers are 10 ft. in diameter, made of boiler iron, and have a thread of 18 in. The steering wheel is 6 ft. in diameter, and attached at the middle of the axle to the forward end of the tank by a ball and socket arrangement. The tank forms the body of the waggon. The boiler is an upright tubular, and aft the driving shaft. The waggon will carry wood and water sufficient for a four hours' run. It consumes one cord per eight hours. The hands required to run the steam waggon are—an engineer, fireman, and pilot."

The "Lord Warden," the new iron-cased frigate to be built at Chatham, will be covered with one uniform thickness of iron plates. Another important feature in the "Lord Warden" will be the placing of a powerful battery of guns, in which she will differ from all vessels of war afloat. This battery will be so placed as to enable the guns to be fired straight ahead, while the solid iron-plated bow will be carried up sufficiently high to form a sort of tower, in which the guns will be placed. The extremity of the front will be furnished with a huge steel stem, shaped somewhat like a cleaver; and this formidable weapon will, it is confidently anticipated, cut completely through a hostile ship, when used as a ram, as, from the enormous size and momentum of a vessel of the "Lord Warden's" dimensions, one, or, at most, two blows would be sufficient to sink the largest vessel afloat. Another vessel of the same kind is to be built at Pembroke, and to be named the "Lord Clyde."

A most importment announcement was made at a ship launch on the Mersey last week. Messrs. Potter and Co. despatched from the stocks a new iron vessel of 1,200 tons, built for Messrs. Boult, English, and Brandon. After the launch about 200 guests partook of lunch in the mould loft; and Mr. T. M. Mackay, of London, in proposing "Prosperity to the good ship 'Bedfordshire' and her worthy owners," made the following remarks relative to the difficulties encountered by the builders of the vessel, owing to the opposition of workmen engaged in the iron shipbuilding trade. Mr. Mackay said:—"Mr. Potter's greatest difficulty to be encountered was the organized opposition of workmen, who, in defiance—I regret to say ignorant defiance—of all the laws of political economy, still allow themselves to be led by the nose to their own ruin and discomfiture, by being really under the terrorism of what I may say, in every sense of the word, is 'club law.' Well, Mr. Potter was not daunted by this. He took into consideration the intelligence of the shipwrights in their manipulation of wood, and believed they might turn advantageously to the manipulation of iron; and bearing in mind that care and attention, far more than dexterity, which is the result of long practice, is necessary, he called the shipwrights of Liverpool into requisition, and the ship you have seen launched to-day is their maiden effort—(loud cheers); and I challenge all the boiler-makers of Liverpool to show me a ship in which the work has been more honestly performed, or in which there is a more perfect finish than in the 'Bedfordshire.' (Loud and repeated cheering.) Now, ladies and gentlemen, there is more involved in this than you would at first suppose, from the fact of a vessel constructed of iron being manufactured by shipwrights who have always wrought in wood, and have never been accustomed to work at iron. But when we consider the great revolution that is taking place in the building of ships—in the change from wood to iron—it is most important to find the aptitude of our mechanics for this change; because it enables them to place us more forward than ever as a nation in the rank of maritime power." (Hear, hear.)

A curious communication was recently sent in to the Academy of Sciences, by M. Morvan, in which he describes a method of his for obtaining direct photographic impressions upon stone, and which he can afterwards print off. He first gives the stone a coating, which he applies in the dark, of a varnish composed of albumen and bi-chromate of ammonia. Upon this he lays the right side of the image to be reproduced, whether it be on glass, canvas, or paper, provided it be somewhat transparent. This done, he exposes the whole to the action of light, for a space of time varying between thirty seconds and three minutes if in the sun, and between ten and twenty-five minutes if in the shade. He then takes off the original image, and washes his stone, first with soap and water, and then with pure water only, and immediately after inks it with the usual inking roller. The image is already fixed, for it begins to show itself in black on a white ground. He now applies gum water, lets the stone dry, which is done in a few minutes, and the operation is complete. Copies may at once be struck off by the common lithographic process.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

161. H. Rushton. *Improvements in machinery for plaiting cotton, thread, or other fibrous material over steel for crinolines, and in the mode of securing the plaiting to prevent it slipping thereon.* Dated January 19, 1863.

This invention consists—1, instead of having a series of dogs or beaters for changing the direction of the tubes, in fixing a series of projections on the circular bar in lieu thereof, thus obtaining greater certainty in controlling the tubes, and increasing the durability of the machine. 2, in giving motion to the circular bar by using a cam made by a groove of suitable shape, in which works a pin attached to the circular bar. The thread plaited over the steel is attached thereto, and prevented from shifting or slipping thereon, by the application of a quickly drying size or varnish upon the surface of the steel; the size is applied by passing the steel between two rollers in the machine, which are covered with flannel, saturated and kept well supplied with the size. *Patent abandoned.*

162. R. A. Brooman. *Improvements in the manufacture of sulphate of soda for conversion into soda and other uses.* (A communication.) Dated January 19, 1863.

When a mixture of coal, sulphuret of iron, and chloride of sodium is heated in the presence of air, sulphate of soda, oxide of iron, and chloride of iron are formed; the proportion of these different bodies varies with the quantities of the substances above named forming the mixture, as also the state of division when used. This invention consists in manufacturing sulphate of soda by reducing to a powder the fuel (charcoal, coal, coke, or other fuel), the natural or artificial sulphuret of iron, and the salt, and in mixing these substances in certain fixed proportions. *Patent completed.*

163. W. H. Harrison. *Improvements in covering wire and other iron articles for the purpose of preventing them from oxidation, and in the mode or method employed therein.* Dated January 19, 1863.

This invention consists in immersing the object to be protected first in a bath of metallic alloy in which lead is present, but of which tin or zinc forms a large proportion; then, after the object has been so coated, treating it mechanically by drawing, rolling, or burnishing, and afterwards immersing the object so coated and treated in a second bath of suitable alloy, composed entirely or nearly entirely of lead, tempered or regulated in its degree of metallic hardness by the addition of bismuth, or other suitable metal, when the article may again be submitted to mechanical treatment as before. *Patent abandoned.*

164. J. J. Lundy. *Improvements in the manufacture of metallic casks and vessels.* Dated January 19, 1863.

According to the common and generally adopted system of manufacture of metallic casks and similar vessels, the bottom end only is swaged into the body of the cask as a fixture, whilst the other end is attached by circumferential straps, or bent holding pieces, with rivets. These holding straps are attached to the exterior of the end of the cask; when the end or head-piece is inserted they grasp the dished flange of the end or head-piece, and thus prevent the latter from moving upwards. And, further, to prevent the end or head-piece from sinking within the cask, the small handle attached to the centre of the head has to be elongated at each end, these ends being converted into bent holding strap pieces to grasp the end rim of the cask. Now, according to the present invention, instead of using the details above described, the dished end or head-piece is swaged firmly in its place with a holding and tightening bead, after the manner commonly adopted for the lower end, which is far simpler and stronger. This makes a perfectly secure and neat cask, and the handle needs no elongation whatever, besides being cheaper in its production than by the old system of closing up the cask when filled with paint or any other substance. *Patent completed.*

165. B. Van der Mark. *A musical instrument called "Mark-harmonica."* Dated January 19, 1863.

The chief aim of this invention is intended to facilitate part-singing of hymns and sacred music at family worship, to encourage the study of vocal music, to promote congregational singing in all churches and chapels, and effective teaching in families and schools. The instrument assumes different shapes, according to the number of performers for which it is intended, viz.:—If for four performers, the instrument may conveniently assume the form of a table, by preference 3 ft. long, 2 ft. 6 in. wide, and 2 ft. 8 in. high, or thereabouts; if for six performers, the form of a hexagon; and if for eight performers, the form of an octagon. The instrument is divided into separate compartments for soprano, alto, tenor, and bass, each compartment containing the full compass of one of these parts; if for six performers, the compartments would, by preference, be as follows—two sopranos, two basses, alto, and tenor; and if for eight performers—two sopranos, two altos, two tenors, and two basses. There are, consequently, either four, six, or eight distinct key-boards to perform upon. Stops may be used instead of keys; and to simplify the performance, each stop is numbered for the guidance of the player, each performer having his own separate part before him, and singing and playing the note marked. The union of voices and players will thus produce vocal harmony with instrumental accompaniment. The sound of each note is produced by a brass or other metallic vibrator through the agency of bellows. The action of one foot will generally be sufficient to feed the instrument with air. *Patent abandoned.*

166. A. Paul. *Improvements in obtaining reciprocating motion in steam engines, and for communicating the same to any ordinary pumps, for whatever purpose they may be employed.* Dated January 20, 1863.

We cannot here give space to the voluminous details of this invention. *Patent abandoned.*

167. J. Mosheimer. *Improvements in machinery for crushing and grinding quartz and other substances.* Dated January 20, 1863.

This invention consists in combining in the same machine the two principles of crushing and grinding quartz and other substances—1, The quartz or other substances is crushed by centrifugal force, and then it is ground fine by a suitable grinding machine. In reference to the first operation, the patentee observes that, if a piece of rock or ore be let fall on to a hard surface from a given height, it will in proportion to the height from which it has fallen, be more or less broken to pieces; therefore, if force be employed to throw a piece of quartz at, for instance, the velocity of 600 ft. per minute against a solid piece of iron, such a tremendous blow is given to the quartz that it will be thrown back and shattered to pieces, and in course of time, if the blows be repeated, the quartz will be reduced to as fine a state as may required; but in order that every particle which escapes reduction by this operation may be reduced to powder, he places under the above crushing machine a grinder which acts on the plan of a grinding mill. This grinder is constructed of iron, and is kept cool by a continual stream of water which is made to pass through its centre. *Patent completed.*

168. J. Bell and J. Speight. *Certain improvements in the construction of carding engines.* Dated January 20, 1863.

This invention consists in an improved mode of constructing the adjustable bearings in which the working and stripping rollers revolve. To the bend or other part of the framing of the carding engine are cast cylindrical studs in the usual manner; on these studs are fixed the adjustable bearings; the plates are provided with toothed racks, and the bearings are furnished with short worms gearing into the racks on the plates. The axle of the worm projects beyond the end of the bearing, and is made square, or of other suitable shape, to receive a screw key. By turning the worm round, the distance between the surfaces of the main cylinder and the working and stripping roller can be adjusted accurately and expeditiously. The worms are made by preference of malleable cast iron. *Patent abandoned.*

169. W. Mawson and J. Whitehead. *Improved hydraulic machinery for raising water in mines, wells, and other places.* Dated January 20, 1863.

The object and intention of this invention is to dispense with the necessity for employing stuffing-boxes in hydraulic machines, and thereby to avoid friction at such parts. The inventors propose to effect this by the following means:—The piston plunger or ram is formed less in diameter than the bore of the cylinder in which it works, and to the bottom of the said ram a piece or pieces of leather of annular circular form is or are affixed, so that the water pressing against the said leather forces it against the circular bore of the cylinder, and makes a perfectly water-tight joint. They propose to form the cylinder of a solid square piece of metal, bored out at its centre, and open at top (having no stuffing-box) to receive the ram. The said cylinder is to be fitted in an oblong cistern containing water; two small pumps fitted with suitable valves are also fitted on the said cistern, and the pumps are worked by a two-throw crank-shaft for injecting water into the square cylinder aforesaid, for lifting the ram and imparting motion to a long lever, an anti-friction roller being adapted to the head of the ram

upon which the said lever rests. The short end of this lever has its fulcrum on a strong pin fixed in a standard, and the longer end of the said lever is connected to the pump rod leading down the shaft of the mine, pit, or other place from which the water is to be raised. By these means a great saving of power may be effected. *Patent abandoned.*

170. H. A. Bonneville. *Improvements in the manufacture of clocks.* (A communication.) Dated January 20, 1863.

This invention consists in regulating the working of clocks by means of the oscillations of a spiral spring with a circular balance wheel, instead of an ordinary pendulum. *Patent abandoned.*

171. H. A. Bonneville. *Improvements in colouring, bronzing, and preserving iron and steel.* (A communication.) Dated January 20, 1863.

The patentee claims—1, The creation at the surface of the iron or steel of an adherent coat of peroxide of iron. 2, The transformation, under the influence of water at an elevated temperature, of the peroxide of iron into black oxide which is less oxidized. 3, The renewing of the operation until this black coat is sufficiently thick and adherent. 4, The immersion of the articles in a bath of lukewarm water, for the purpose of removing the acidulated or saline particles adhering to their surfaces, and allow of being greased with olive oil. *Patent completed.*

172. M. Henry. *Improvements in apparatus for retarding and stopping railway carriages.* (A communication.) Dated January 20, 1863.

This invention relates to the mode of stopping or retarding carriages on railways, and consists of improved apparatus for the purpose, in which apparatus for working the breaks is so combined with the apparatus for connecting or coupling the carriages that the breaks are applied and caused to stop or retard the carriages by the action of uncoupling or disconnecting the carriages from each other. This may be done, in one arrangement, by a chain or like agent extending to within easy reach of the driver or other attendant of the train, and connected under each carriage to a bar, rod, or shaft, hereinafter called the "disconnecting shaft." Each coupling hook is held to the carriage by a bar, rod, or piece, herein called a "key," kept in place by a moveable notched or hooked piece connected to the disconnecting shaft by a crank, link, or jointed lever. When the chain is pulled or drawn, the disconnecting shaft is turned partially round or oscillated, so as to move the notched or hooked piece and release the key therefrom, whereupon the key will be forced upward (or in the required direction) by a spring, and will liberate the coupling hook from the carriage, the momentum of the latter facilitating the action. The same action of the disconnecting shaft that disconnects the carriage also works the breaks. *Patent abandoned.*

173. W. Clark. *Improvements in looms for weaving textile fabrics.* (A communication.) Dated January 20, 1863.

This invention consists in weaving fabrics in a circle, or any part of a circle, and in rising a plurality of shuttles passing through a warp or web at the same time, and in carrying the shuttle or shuttles through the warp by means of friction rollers, pulleys, belts, or their equivalents, and by beating up the weft or filling in sections. *Patent completed.*

174. J. Smith and S. A. Chease. *A new description of motive-power engine, to be called the "Displacement Engine."* Dated January 20, 1863.

This invention consists in certain mechanical appliances so arranged as to co-operate with the motive power of air and water, each of these powers being subject to the action of gravitation in proportion to its ponderability. *Patent abandoned.*

175. H. Hughes and J. Sanders. *Improvements in machinery and apparatus for the manufacture of trimmings and cap-fronts.* Dated January 20, 1863.

This invention consists in constructing machines for making, and apparatus for folding, trimmings and cap-fronts as hereafter described. These trimmings and cap-fronts consist of loops of ribbon, chenille, silk, or other fabric, with or without goffered net or quilling between the ribbons. The inventors take a roller or mandril, the shape and size of which may be varied, and they mount this roller in a frame in such manner that it may be made to rotate. The roller is formed of two halves or otherwise, so as to leave two grooves along its whole length; in each of these grooves they place two strips of net or other foundation, covered with gum or other adheive material, or they lay on the strips gummed thread to cause the ribbon to adhere to the foundation strips. They place a threaded shaft parallel with the grooved roller, and through a nut they connect a bobbin or reel, carrying the ribbon to be used in forming the trimming or cap-front to the threaded shaft. In some cases, for the purpose of varying the trimming or front, they use two or more different ribbons, and lay them alternately; they connect as many bobbins to the shaft as there are different ribbons. By wheel-work they drive both roller and threaded shaft from one main wheel, but other gear may be used. Supposing the machine ready to work, they fix one end of the ribbon from the bobbin on the grooved roller, and cause both roller and shaft to revolve; the bobbin will be carried along the machine, and the roller will wind in itself the ribbon from the bobbin. When the ribbon becomes wound on its whole length, it is dried, a knife or cutter is run along each of the grooves, and the ribbon thereby severed. The fabric removed will be in the form of two sets of strips of ribbon, the ends of which will be united to the two longitudinal strips of gummed foundation. Or, before being dried, the material may be dressed. The strips of ribbon may be embossed or not, as desired; and the strips or ribbon being doubled or folded the two foundation strips are brought one over the other, and are secured by a banding machine or by sewing in a sewing machine, or otherwise. The strips of ribbon may be partly or entirely goffered or not. For inserting the goffered net between the ribbons, they use an apparatus made with flaps to fold over and hold down the foundation strips, while the goffered net is being inserted. The strips of ribbon are received in a hinged "making-up" box; they use a guide for the insertion of the goffered net; and after the strips of ribbon have been placed in the box and the edges held down by the flaps, the goffered net is inserted, one flap removed, and the strips of ribbon folded over the net, the box is then turned over, leaving part of the foundation strips exposed. The remaining flap or flaps are then removed, and the making-up box with its contents is taken away. The protruding edges are caused to adhere by means of a heated press. *Patent abandoned.*

176. S. Blackwell. *Improvements in apparatus for applying water or other fluid to the legs and other parts of horses and other animals.* Dated January 20, 1863.

For the purposes of this invention, in order to apply water or other fluid continously for any desired length of time to the leg of a horse, or any other animal, with a view to cool, foment, or poultice the same, a hollow tube or band (which, by preference, is composed of galvanized india rubber) is used; this is perforated with numerous small holes, so as to divide the water or fluid into numerous small streams. The ends of this perforated tube or hollow band are closed, and a flexible supply pipe is connected to the hollow perforated band or tube, whilst the other end of the supply tube is connected to a vessel containing water or other fluid. To regulate the flow of the fluid, the supply tube may have a valve or cock applied to it. The vessel which contains the water or other fluid is arranged to be fastened on the back or other part of a horse; or it may be otherwise placed and supported when circumstances require it. The perforated tube or band is attached to or around the leg by a strap or otherwise. When desired, sponge or other porous and absorbent covering may be placed and secured over the part of the leg where the fluid is to be applied, so as to act as a poultice, or the water or fluid may be caused simply to flow in numerous streams over the parts of the leg requiring such treatment. *Patent completed.*

177. J. W. Meeks. *A new and improved method for making sash-frames and sashes, and suspending the same by atmospheric pressure or otherwise.* Dated January 21, 1863.

For the purpose of this invention, instead of suspending and working the sash as at present, by lines, weights, and pulleys, the patentee fits it with tubes of elastic material charged with atmospheric air or with gas. These tubes are attached to the sash one on each side thereof, in a groove or recess therein, and (when working with the sash) they slide up and down in corresponding grooves or recesses in the joints or fixed sash frame or window frame, and thus retain the sash at any required height in the frame. Each such groove or recess may be semicircular, or semi-elliptical, in horizontal section, and, when the sash is in the frame, each recess in the sash has opposite to it a corresponding recess in the fixed sash frame or jamb, such two opposite recesses, when together, form a cylindrical or elliptical space, in which is the tube fitting closely, one half in the sash groove and the other half in the frame or jamb groove. The tubes are made of caoutchouc, gutta percha, or of caoutchouc or gutta percha compounds, or of other flexible and elastic material, and are hermetically closed or secured at both ends. They are charged, with pumping or otherwise, with air or gas under such pressure as may be required to sustain the weight of the sash by means of any suitable apparatus for injecting the air or gas, and closing the same when filled, as is well understood. *Patent completed.*

178. A. Phillips. *Improvements in looms for weaving figured fabrics.* Dated January 21, 1863.

The patentee claims—1, The system or mode of weaving figured fabrics by means of the mechanical arrangement or combination of parts described. 2, The system or mode of forming the loops on the surface of the figured fabrics by means of a series of loop-formers, upon which the woollen weft is indented in the manner described. 3, The system or mode of forming the loops or indenting the weft of figured fabrics produced according to this system of weaving by means of a series of loop-forming levers, which operate in conjunction with the loop-formers, together with the arrangement for actuating the levers, or any mere modification of the same, as described. *Patent completed.*

179. T. Wright. *Improvements in the manufacture of cast-iron pipes, and the apparatus employed for the purpose.* (A communication.) Dated January 21, 1863.

Provisional protection has not been granted for this invention.

180. F. A. Busch. *Improvements in the manufacture of metallic vessels or receptacles for containing liquids or substances.* Dated January 21, 1863.

In carrying out this invention, the inventor proposes to form the vessels, whether in the form of bottles, jars, or otherwise, of a base metal, such as iron, and to immerse them in a bath or solution of a noble metal, such as platinum, silver, or gold, bringing the poles of a galvanic battery to bear upon the articles and upon plates of the desired noble metal, whereby the plates will become dissolved and the metal deposited on the interior and exterior surface of the base metal, thus producing a surface capable of withstanding oxidation and the effects of acids or solutions. *Patent abandoned.*

181. J. M. Kirk. *Improvements in finishing textile fabrics.* Dated January 21, 1863.

This invention consists—1, in the employment of thin metal plates, instead of press papers, for placing betwixt the folds of the textile fabrics to be pressed, which plates are heated by any suitable means previous to the placing of them in the folds. 2, in the employment of a series of hollow metal plates, arranged so as to form a tier of shelves, leaving spaces betwixt in which to place the thin metal plates to be heated by means of steam or other heating media being passed through the said hollow plates; such hollow plates may or may not be enclosed by a casing and doors or otherwise, so as to form an oven. 3, in the employment of a hand press for each piece or fabric by each person engaged in folding and placing the hot plates in the fabrics. *Patent abandoned.*

182. H. B. Barlow. *Certain improvements in jacquard machines.* (A communication.) Dated January 21, 1863.

This invention consists in substituting thin metallic plates for cards usually employed in the jacquard machine. *Patent abandoned.*

183. J. Holt. *Improvements in willowing and opening cotton and other fibrous substances.* Dated January 21, 1863.

This invention consists in admitting steam to the cotton or other fibrous substance during the time that it is being operated upon by the willow or opener. In performing this invention, the patentee makes use of a willow or opener of the ordinary construction, and he introduces a jet of steam between the inside of the casing and the exterior of the drum or beater, or in any other convenient situation. The pipe for supplying is furnished with a tap, which is closed when the door in the casing has been opened to discharge the cotton or other fibrous substances. *Patent completed.*

184. A. Bourée. *Improvements in apparatus for casting or moulding articles in glass, and in imitation of precious stones or marbles.* Dated January 21, 1863.

This invention relates, in the first place, to the manufacture of glass globes for lamps or lanterns, for the purposes of signal lights and other uses, watch glasses, and other articles in glass in which a varied or ornamental surface is required. The invention consists in the construction and use of moulds formed in three or more parts, but by preference in three parts, united by two hinges, such moulds having formed in them perforations of any required number, size, and shape, so that portions of the molten glass when blown into them may be caused to protrude through the perforations and constitute curved projections on the surface of the article, or separate curved glasses when detached from the intervening portions of glass by which they are united in the mould. The invention also consists in the use of an instrument in the form of a vice or pincers, with suitably formed dies inserted in the jaws thereof, in which the molten composition is inserted and pressed, and with a vertical rod or stem, capable of adjustment as to height, in order to make the requisite cavity in certain of the articles by occupying the space that would otherwise be occupied by some of the composition or material. The invention consists further in the use of a mould hinged as stated above, but instead of having perforations with the interior formed to suit the required shape of the articles, they are caused to take their shape by the pressure given to the composition or material by the operation of the workman. *Patent completed.*

185. W. Clark. *Improvements in preparing and obtaining photogenic pictures or representations.* A communication.) Dated January 21, 1863.

This invention relates to a photogenic process, whereby a positive image may be obtained direct from a positive by the employment of ammoniacal salts, combined with the organic matter, and also by the precipitation of the following metallic solutions, viz.:—Salts of silver, copper, iron, nickel, mercury, gold, palladium, platina, lead, or tellurium, which are precipitated by means of hydro-sulphates of ammonia, potash, or soda. The salts of silver, bismuth, or lead are precipitated by means of hydro-sulphuric acid; and the salts of mercury, by hydro-chlorate of tin. The salts of bismuth may also be precipitated by means of nut galls, gallic or tannic acids; and the salts of iron, by means of the same agents last mentioned. The inventor takes, for example, the sulphate of iron precipitated by means of tannic acids. *Patent completed.*

186. W. Clark. *Improvements in desiccating and in preserving matters from decay.* (A communication.) Dated January 21, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

187. E. Bazin. *An improved log.* Dated January 21 1863.

This invention is not described apart from the drawings. *Patent completed.*

188. C. H. Roeckner. *Improvements in machinery and process for reducing wood to a fibrous condition, for the manufacture of paper stuff or pulp.* Dated January 21 1863.

Provisional protection has not been granted for this invention.

189. C. Lindsay. *Improvements in apparatus to be used on railways to indicate to the engine-driver of a carriage train the length of time which has intervened since the passing of a previous train.* Dated January 21, 1863.

For the purposes of this invention, at intervals along e line of railway, apparatus is erected consisting of a pendulum placed in a suitable case, part of which is made transparent, so as to expose such part of the pendulum as may be desired to the view of the engine-driver of a coming train, and so that it may be clearly seen by day and by night, the apparatus being properly lighted at night. A fixed graduated dial is applied to the case, within which the pendulum works, which is also to be exposed to view so as to be seen by the engine-driver of a coming train. The graduated scale and the pendulum are to be of such dimensions, and so arranged that they may be clearly seen at a considerable distance. The pendulum is to be acted on by each passing train, so as to place it to a determined distance beyond its perpendicular position, and then release it, so that it may be allowed to vibrate freely. The length of time which has intervened since a previous train has passed will be indicated (if the pendulum has not come to rest) by the reduced arc in which the pendulum is vibrating as compared with its greatest vibration. The dial is to b graduated to indicate minutes or other determined measure of time. *Patent completed.*

190. A. Pennington. *Improvements in apparatus for beating mats, rugs, and other such like articles.* Dated January 21, 1863.

For the purposes of this invention a rectangular box or

case is employed, of a length and width depending on the sizes of the mats, rugs, or other like articles to be beaten. Near the upper part of this box or case is a partition, by preference horizontal, and made with iron hooping crossed or interlaced, so as to produce a reticulated partition; or the reticulate partition may be made of other suitable material, and in any other convenient manner. Below the horizontal partition is a chamber or bin, in which the dust which is beaten out from the mats, rugs, or other like articles is received, and such dust is from time to time to be removed from the lower chamber or bin, which is made with a door, or is otherwise conveniently arranged to admit of the dust being readily removed from below the reticulate partition. The upper part of the box or case is covered over by a hinged lid, or other suitable cover, below which is a strong canvas or other close-woven or flexible fabric cover, which is by preference arranged to be wound on a roller when out of use. In using this apparatus, the hinged or upper cover or lid is opened or removed, the mat, rug, or other like article is to be placed with its upper surface or face downwards on the reticulate partition, the canvas cover is to be drawn over the mat, rug, or other article, and over the reticulate partition, in order that no dust may be permitted to rise when the mat, rug, or other article is being beaten by a stick, cane, or any other suitable beater. *Patent abandoned.*

191. N. CLAYTON and J. SHUTTLEWORTH. *Improvement in rotary screens, suitable for screening wheat and other grain or seed.* Dated January 21, 1863.

For the purposes of this invention, the patentees make th screening drum of polygonal section, and each side of the polygon they make of two flat metal plates perforated with holes or slits; the plates are perforated to correspond the one with the other, and are placed in contact. One plate of each side the polygon is fixed, and the other is able to slide thereon a short distance, so that it may be set more or less to cover or close the holes or slits in the first plate, and in this manner the gauze of the screen is adjusted as may be required. The sliding plates are by means of springs pressed constantly towards one end of the screen, and they are caused to bear on a moveable ring at the end of the screen; this ring is made with inclines upon it. The ends of the moveable plates have also inclines upon them, corresponding with those on the moveable ring, so that the position of this ring on the end of the screen will regulate the position of the moveable plates. The moveable ring is arranged so that by means of a screw it may be adjusted in position, and firmly held in whatever position it may have been placed. They also make the screen self-cleansing—that is to say, they cause any grain, seed, or other substance which may become jammed in the openings or spaces when the plates are sifting to be released when the plates come in the course of the rotation of the drum to the upper side thereof. To effect this, they mount a friction pulley at the top of the screen, and near one end thereof each of the moveable plates has a projection upon it, and as the screen revolves, these projections come in succession in contact with the stationary pulley, and thus the plates receive a slight motion sufficient to increase the width of the hole or slit, and so let anything which may have become jammed therein to fall out. The springs cause the moveable plates to return to their original position immediately after passing the pulley. *Patent completed.*

192. H. CARO and J. DALE. *Improvements in obtaining colouring matters, which improvements are also applicable to dyeing and printing.* Dated January 21, 1863.

This invention consists—1, in treating colours derived from aniline with the substance known as acroleine, whereby the said colours become modified. Also in treating mauve or aniline purple with aniline and benzoic acid under heat, whereby the tint is modified and a blue colouring matter obtained. *Patent completed.*

193. H. HOLCROFT. *Improved machinery for separating substances of different specific gravities.* Dated January 21, 1863.

This invention relates to a novel construction of automatic machinery, whereby crushed ores or mixtures of granular and other substances supplied thereto may be assorted or separated according to their specific gravities. The machine, which admits of many modifications in its constructive features, is used in conjunction either with a head or stream of water or other fluid, or of compressed air or other gaseous body, according to the nature of the substances to be operated upon. The principle of action, however, of the machine, whatever may be the modifications in the details of its construction, will in all cases be the same, the object being to obtain by the action of a vortex (into which the substances to be assorted are thrown) a separation according to their specific gravities of the substances under treatment, and their deposition in different positions in the vortex vessel, from which they may be discharged automatically into separate receptacles. *Patent completed.*

194. W. HARRISON and B. CROASDALE. *Certain improvements in looms for weaving.* Dated January 22, 1863.

This invention consists—1, in an improved shedding motion. In performing this part of the invention the shedding levers are placed above or in front of the tappet shaft; the eccentrics or tappets acting on these levers give the requisite up-and-down motion to the treadles for forming the shed. The fulcrum of the shedding levers is adjustable to vary the opening of the shed, or the length of the levers can be varied. The second part of the invention consists in an improved arrangement of mechanism applicable to an ordinary twill loom, whereby such a loom may be employed for weaving lenoes or gauze. In performing this part of the invention, the inventors employ four heddles through which the warps are drawn, so that the alternate warp threads are crossed when weaving. They also employ two roller shafts, the rollers on the upper one being connected to two of the heddles by elastic bands or springs. They also employ a rocking vibrator, acted upon by a tappet on a tappet shaft, for slackening a portion of the warp after every two or four picks, or when the crossing takes place. *Patent abandoned.*

195. J. C. BRANDES. *An improved hair creaser or divider.* Dated January 22, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

196. J. GRANT. *Improvements in the construction of sidings and loop lines for railways or tramways, whether portable or otherwise.* Dated January 22, 1863.

This invention consists, in the first place, in two novel modes of constructing a siding so that it may be placed in position at any part of the main line, and on either side of it, so as to be used for turning carriages out of the main line on to such siding, or from the siding on to the main line, by raising or supporting such trucks or carriages above the rails of the main line, without the necessity for any cuts or gaps through such rails. The invention relates—2, to the combination of a pair of such sidings connected by intermediate rails so as to form a loop line. *Patent completed.*

197. J. ELLACOT. *Improvements applicable to spur-wheels, racks, and other toothed gear, to ensure greater strength in the teeth.* Dated January 22, 1863.

This invention consists in the use of two, three, or more combined teeth placed side by side, and in advance of each other according to the pitch. *Patent abandoned.*

198. J. M. BINGER. *The composition of a kind of pulp proper for the manufacturing of printing and typographical rollers.* Dated January 22, 1863.

This invention relates to an improved paste or pulp for covering the rollers used by letter-press printers to convey the ink or colour to the type, blocks, or plates, and consists in mixing together, in any required proportion, glue, syrup of molasses, gum arabic, rectified spirits of wine, acetic acid, creosote, powdered cloves, and common salt. *Patent completed.*

199. R. PENNEY. *An improved solution or mixture for fixing certain colours employed in printing calico and other fabrics.* Dated January 22, 1863.

This invention relates to the fixing of those colours employed in printing calico and other fabrics which are produced by means of catechu, and usually called catechu colours. For this purpose the patentee employs a solution or mixture made in the following manner, and treats the catechu colour therewith:—He takes of the ordinary chloride of calcium of commerce (which may be made by saturating spirits of salts with quicklime in a powdered state) three, four, five, or other number of parts, and mixes therewith one or other required number of parts of nitrate of copper, at 80 deg., or other required strength, or of chloride or muriate of copper, either instead of nitrate of copper, or in combination therewith; such admixture is to be made whilst the calcium is in a heated state, and then filtered for use. These parts must be varied according to the depth, shade, or tone of colour to be treated. *Patent completed.*

200. W. and J. BLACKWOOD. *Improvements in machinery for drying yarns or threads.* Dated January 22, 1863.

This invention has for its object the convenient and efficient treatment of any kind of yarns or threads when in the hank form. In a modification embodying these improvements, there are two or three cans or hollow cylinders formed with tubular spindles projecting from one end only, and mounted in bearings in such a way that the cans are overhung. The ends of all the spindles are entered into stuffing-box bearings communicating with steam passages, whereby steam is admitted into the cans. The two side cans are made to rotate by means of suitable gearing upon their spindles, but the middle can is turned by the friction of the yarn or thread passing in contact with it. This middle can is also made to put the requisite tension on the yarn, the bearings of its spindle being arranged to allow the can to bear down upon the yarns, and, if its own weight does not give sufficient tension, additional weight may be applied to it. *Patent abandoned.*

201. W. CLARK. *An improvement in piston valves and other pistons.* (A communication.) Dated January 22, 1863.

This invention consists in the construction of a piston valve, or of any piston with an expanding ring, having the head and follower fitted to its interior, and with a dovetail wedge so applied in connection with the ring head and follower as to make the valve or piston as much like a solid block as is desirable, yet capable of being set out to fit the cylinder in which it works and compensate for wear. *Patent completed.*

202. N. WOOD and J. STOCKLEY. *Improvements in apparatus for grinding, smoothing, and polishing plate glass.* Dated January 22, 1863.

This invention consists in constructing and using moveable grinding benches capable of being transported to the apparatus for smoothing and polishing, thereby admitting of one side of the glass being finished in all the processes without the necessity of lifting and relaying the glass in the manner required when the ordinary benches are used. The mechanism applied to the benches for rendering them moveable may be arranged so as to admit of their being transported as required, either throughout the whole series of apparatus for grinding, smoothing, and polishing, or from or to any part thereof. For this purpose the benches are constructed of the usual materials, with a smooth upper surface for the glass to rest upon, and are fitted into a frame provided with wheels or sliding pieces carried upon or in suitable rails or grooves supported on the floor of the shed or shop, upon or in which rails or grooves the benches may be moved in the directions required. There are also combined with the rails or grooves at suitable intervals turn-tables, sidings, or sliding frames, so as to admit of the benches being drawn aside or changed as required. The required progressive motion is imparted to the benches by means of racks and pinions, or other suitable mechanical means. *Patent completed.*

203. T. LAMBERT. *Improvements in apparatus for drawing off water and other fluids.* Dated January 22, 1863.

For the purposes of this invention, in constructing apparatus or taps for drawing off water or other fluids, one end of the barrel is made with a screw or otherwise, suitable to be fixed to a pipe or other source of supply in the ordinary manner. At the other end a suitable valve chamber is formed or applied, the opening into which is covered by a valve, which is preferred to be covered with a suitable yielding and elastic material. Over the valve chamber is a hollow cover which communicates with the valve chamber. This hollow cover has a flange at the end or part where it is connected to the valve chamber of the barrel. The hollow cover is fixed to the valve chamber by a clamping hollow plate through which there is a hole suitable for the passage of the hollow cover. The clamping plate when fixed to the valve chamber or barrel presses on the flange of the hollow cover in such manner as to attach the hollow cover to the valve chamber or barrel, but so as to allow the hollow cover to rotate or turn partly round. The valve spindle or stem is formed with a screw thereon, and the piston is prevented turning in the valve chamber. On the interior of the hollow cover is fixed or formed a screw nut, which works on the screw on the spindle or stem of the valve. The spout or tubular passage through which the water or other liquid is discharged is fixed to or formed on the hollow cover, and is a branch therefrom which serves as a handle to turn the hollow cover, and thus to open and shut the valve. It is not essential that the spindle or stem of the valve should be formed with a complete screw, but such is preferred to be the case, as by its having an inclined thread or groove, so long as the nut carried by the hollow cover is made agreeable thereto, the same lifting and closing of the valve by the turning of the hollow cap will result. *Patent completed.*

204. C. LUNGLEY. *Improvements in means for facilitating the repairs of ships and other structures.* Dated January 22, 1863.

This invention consists in digging or forming pits in the ground, and placing therein caissons with trunks for access and for air. Or the inventor makes the pits water-tight with cement or other materials suitable for the purpose. He fits a campshead of wood or other material, to receive the fittings for making the parts water-tight round the ships or other structures when they are brought over the pits. *Patent abandoned.*

205. F. W. MORLEY. *Improvements in boilers for steam engines, and in valves to be used therewith.* Dated January 22, 1863.

In carrying out this invention, the inventor proposes to make the shell of the boiler of any of the ordinary forms, according as it may be intended for locomotive, marine, or stationary engines, and he applies in lieu of the fire bars at present in use a series of copper tubes, through which the water circulates from the boiler by means of their insertion into the lower part thereof; these tubes therefore will serve the purpose of fire bars, and at the same time communicate heat to the water, which will circulate through them, and ascend to the upper level, while the water of lower degree of temperature will descend to supply the circulation. He proposes to insert a number of fire or hot vapour tubes into the lower half of the boiler, and to insert another series of tubes into the upper half thereof, which tubes are to communicate with the water in the boiler. The valve whereby the supply of steam is regulated to the engine consists of a disc cut with two triangular slots, the disc working reciprocally against the face of a stationary corresponding inlet and exhaust to the cylinder. Motion is given to the disc by means of an eccentric on the shaft of the engine, and the disc being set on a steel pin is always ready to be tightened to its work, so as to prevent leakage by friction consequent from its working. *Patent abandoned.*

206. J. MILNER. *Improvements in steam engines.* Dated January 23, 1863.

The patentee claims the construction of slide valves to two steam cylinders that are in proximity to each other, in which each slide valve not only admits and discharges steam to and from its own cylinder, but also, either by itself, or in combination with one or more passage pieces, serves to cut off the steam entering into the other cylinder. *Patent completed.*

208. E. STRANGMAN. *Improvements in pipes for smoking tobacco.* Dated January 23, 1863.

According to one method of carrying out this invention, the patentee makes the pipe with a moveable thimble, with a flange at the top, and perforated at the bottom, such thimble being placed in the bowl, and intended to contain the tobacco or other vegetable substances to be smoked; and he fills the space between the thimble and the bowl of the pipe with a suitable filtering and absorbent material, so that the smoke in passing from the ignited tobacco to the mouth of the smoker is compelled to pass through the said filtering and absorbent material, and thus becomes purified and deprived of all poisonous and deleterious qualities. *Patent completed.*

209. C. STOFFORD. *Improvements in the construction of hats and other coverings for the head.* Dated January 23, 1863.

In the interior of the hat, or other covering for the head, is placed a band of suitable material, the same being of less depth than the side crown, and attached by the lower part thereof to the interior of the band of the hat or other covering for the head, the upper part of such internal band being left loose and unconnected with the side crown or corresponding portion of the hat or other covering for the head, so as to leave a space between the latter and the internal band for the free passage of air. In order that the air may have free ingress to the space between the side crown and the said internal band, the band of the hat or other covering for the head is perforated or made with apertures therein, such perforations or apertures extending either entirely round the band or only partially round the same. The said perforations or apertures in the band of the hat may be covered and protected externally by a band formed of silk, or other textile material, so woven as to be pervious to the air, and thus allowing it to pass through the perforations or aperatures. At the top of the crown of the hat is an aperture or apertures covered with any pervious material adapted for the passage of the air through the same. *Patent completed.*

210. F. N. GISBORNE. *Improvements in the means of communicating signals on board ship, and of indicating the position of the rudder.* Dated January 23, 1863.

This invention is not described apart from the drawings. *Patent completed.*

211. W. CLARK. *Improvements in mariners' compasses.* (A communication.) Dated January 23, 1863.

This invention relates to the application of electric circuits in an easterly and westerly direction in a ship's compass, in order to compensate for and ascertain the deviation of the needle, as also for finding the direction of the magnetism influencing it. *Patent abandoned.*

212. P. A. COLE. *Improvements in the articles of dress known as collars, cuffs, wristbands, shirt fronts, habit shirts, and petticoats.* Dated January 23, 1863.

Having treated india rubber or gutta percha so as to bring the same to a white state, which the inventor does, for instance, by the use of magnesia, or by the process known as Dr. Cattell's process for purifying india rubber or gutta percha, he stamps or places upon the same lines or dots representing stitching, or devices or ornamentation of any kind. *Patent abandoned.*

213. C. TURNER. *Improvements in the manufacture of felted fabrics.* Dated January 23, 1863.

The object of the present invention is to enable the carrier to take across any desired numer of threads at one time, all parallel to each other throughout, and without any angling near the selvages, and also without there being any accumulation of the threads at the selvages. For this purpose the patentee causes the carrier to traverse to and from side to side of the batt as before, taking with it any desired number of threads, which it lays on the batt at regular distances apart. When the threads come to a selvage, they are, by a brush or otherwise, pressed in amongst pins or points; they are also retained by a blade which descends on to them and nips them; or they are taken by any suitable holding instrument, and in place of being left continuous, as heretofore, they are then cut off, the loose ends of the threads descending from the carrier are also retained in a holder. The batt with the pins or points, or other instruments, are then caused to move forward a distance equal to the width of the sheet of threads taken across by the carrier, and the carrier then returns to the opposite selvage, where the operation of retaining the ends of the threads and cutting them off is repeated, and so the work continues. *Patent completed.*

214. E. T. HUGHES. *Improvements in breech-loading fire-arms.* (A communication.) Dated January 23, 1863.

This invention relates—1, to a novel arrangement of mechanical parts for raising the breech end of the barrel from the breech sufficiciently for the introduction of the charge or cartridge, as well as for closing the same ready for fire; 2, in a mechanical arrangement of parts for forcing the extremity of the barrel in contact with the breech. For the first part of the invention, the inventor unites the barrel to a bed extending from the breech under the said barrel by a joint, and by means of a lever, one part of which is jointed to a tongue protruding from the under side of the barrel, whilst another part is in communication with slots or passages cut in the under part of the breech; he opens the gun to the required extent, and recloses it ready for fire. For the second part of the invention, he makes use of a wedge placed under the barrel, and at right angles with the same, and by means of a screw drawing down the said wedge, he causes the extremity of the barrel to be forced up against the breech. *Patent abandoned.*

215. A. O. GLOSSOP. *Certain improvements in the construction and manufacture of breakfast cruet, liquor, and other frames, or articles, used in dinner and other services.* Dated January 24, 1863.

For the purposes of this invention, glass, porcelain, or other similar substance is used in connection with a metallic or other framework, combined or in separate parts, in such way or manner as may be considered desirable for the formation of the same. By this arrangement, novelty and elegance of design are obtained as well as cheapness. *Patent abandoned.*

216. W. MELLOR and W. WHALEY. *Improvements in steam-hammers and other engines driven by steam.* Dated January 24, 1863.

This invention consists in communicating motion to the slide valves of steam-hammers and other engines driven by steam by means of a screw, which passes through a nut formed in the piston, so that as the piston moves up and down, or to and fro in the cylinder, the screw is turned round in opposite directions. This screw is made of the same piece or attached to another screw acting on a nut connected to the lever to which the valve spindle is jointed. By this means the slide valve is moved to and fro to open and close the steam ports in the valve box. Another part of this invention consists in connecting the valve lever to a rod acted upon by levers and rods for the purpose of varying the position of the fulcrum of the lever, so as to increase or diminish the length and force of the stroke. The invention may be modified by placing the screws to one side of the piston rod; in this case, one of the screw nuts is connected to a projection on the hammer head, and the other is connected to the valve spindle. *Patent completed.*

217. W. ALLEN and W. JOHNSON. *Certain improvements in machinery or apparatus for grinding or pointing the cards employed in carding engines.* Dated January 24, 1863.

This invention is designed to produce taper or needle-like points at the carding extremities of the wires constituting the cards. The ordinary method of grinding cards has been by means of an emery roller, having a hard and even surface or periphery which grinds the cards into the form termed "chisel-edged." These improvements consist in the employment and use of a cylinder or cylinders or rollers having their surfaces or peripheries corrugated or ribbed in a direction across their axis, and coated with emery or other grinding material, a reciprocating motion across the cards, and parallel to the axis of the card roller, being imparted thereto, so that the sides of the grinding corrugations, elevations, or ridges come into contact with the wires, as well as the apex of the ridges, and thus produce taper points upon the cards, which are more efficient in their operation upon the cotton. These elevations, corrugations, or ridges may either be formed helically, that is, coiled around a roller in a spiral course, which is preferred, or they may be composed of a series of rings side by side, and they may consist of india rubber, gutta percha, or other yielding substance coated with emery, or they may be made of wood or other non-elastic substance, but an elastic substance beneath the emery is preferred. *Patent completed.*

218. E. SHACKLETON. *Improvements in looms for weaving.* Dated January 24, 1863.

This invention consists in a means of instantly stopping the rotation of the boxes; also the action of the indicating apparatus when the weft breaks or becomes used up, although the loom may continue to run one or two picks afterwards. For this purpose a drop rod is suspended by the ordinary knocking-off lever when in position or working order, and this rod supports a weighted lever hinged to the loom end in a suitable position. When the weft breaks or becomes used up, the weft fork acts in the usual manner to stop the loom, and by removing the knocking-off lever out of position it allows the rod to drop, and also the weighted lever, which lifts or removes the ordinary hooked rods out of contact with the cylinder of the indicating apparatus, also the pawl out of gear with the ratchet by which it is turned, and also applies a brake to assist in stopping the loom. *Patent abandoned.*

219. E. and G. BOOTH and A. SWALLOW. *Certain improvements in the mode of fixing colouring matter or cotton, silk, wool, and other fibres and materials, and certain improvements in finishing such like and other textile fabrics and yarns.* Dated January 24, 1863.

This invention consists in the use of a solution of spirits of salts, lime, and nitrate of copper, mixed together in certain proportions, according to the depth of colour required, which the inventors use as a substitute for nitrate and acetate of copper and other acids now in general use for fixing catechu and other colouring matters in printing and dyeing processes; and for stiffening and finishing textile fabrics and yarns, they use spirits of salts and a solution of lime mixed in certain proportions, which they apply to the fabrics or yarns in the ordinary manner. *Patent abandoned.*

220. M. A. F. MENNONS. *Improvements in machinery for punching and cutting metals.* (A communication.) Dated January 24, 1863.

This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated July 16, 1863.

1778. H. Mège, 4, South-street, Finsbury, professor of chemistry. Certain improvements in the mode of treating fatty bodies.

Dated July 21, 1863.

1821. C. H. Roeckner, Richmond-terrace, Clapham-road. Improvements in machinery and process for reducing wood to a fibrous condition for the manufacture of paper stuff or pulp.

Dated July 30, 1863.

1884. J. W. Branford, merchant, March, Cambridgeshire. An improved agricultural implement for hoeing and cleaning the land, and for cutting or setting out the plants of root crops at certain distances from each other.

1889. G. Smith, jun., 230, King's-road, Chelsea, civil engineer. Improvements in buffing and traction apparatus of railway carriages and waggons.

Dated July 31, 1863.

1897. B. Johnson, Church-street, Camberwell-green, pianoforte manufacturer. Improvements in pianofortes.

1899. A. R. Arrott, St. Helen's, Lancaster. Improvements in bleaching certain vegetable fibres used for textile or other purposes, whether in the raw state or manufactured.

Dated August 1, 1863.

1907. T. Bradshaw, Bolton, Lancaster, broker. Certain improvements in machinery or apparatus for giving motion to "Dobby horses," flying and swinging boats, or similar apparatus used for public amusement.

1908. R. E. Bibby, Manchester, Lancaster, drysalter. An improved fireproof cement, which may be employed for covering walls, ceilings, and floors, and is also applicable in the manufacture of fire-bricks, crucibles, retorts, melting pots, and for other purposes where fire-resisting properties are required.

Dated August 3, 1863.

1914. B. W. Gerland, Macclesfield, Cheshire, analytical chemist. Improvements in the manufacture of size, glue, and phosphates.

1915. J. I. P. Bonnet and J. Pfister, 7, Rue Thèvenot, Paris, lamp manufacturers. Improvements in lamps.

Dated August 4, 1863.

1923. J. H. Walsh, Kensington. Improvements in breech-loading firearms, and in the means of extracting cartridge cases therefrom.

Dated August 5, 1863.

1928. E. A. Cowper, 35a, Great George-street, Westminster. Improvements in furnaces for heating air, steam, and other elastic fluids.

1930. G. Wilkins, Birmingham, gunmaker. A new and improved means of railway signalling.

1933. W. Hodson, Hull. Improvements in machinery used for propelling carriages and vessels.

Dated August 6, 1863.

1935. G. Gowland, Liverpool, chronometer maker. Improvements in mariners' compasses.

1936. C. Lowe, Bradford-street, South Bradford, Manchester, manufacturing chemist. Improvements in dyeing and printing.

1939. W. P. Hodgson, Hylton, near Sunderland, and J. V. Woodifield, Hope-street Foundry, Sunderland. Improvements in machinery for the manufacture of rivets.

1941. J. Young, Bucklersbury, gentleman. Improvements in the preservation of animal matter.

1944. G. E. Charageat, 89, Chancery-lane. Improvements in the construction of frames for umbrellas and parasols.

1945. E. E. Quelle, Bermondsey, skin dyer. Improvements in inkstands.

Dated August 7, 1863.

1949. W. Jones, Warrington, engineer. Certain improvements in steam boilers.

1951. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improvement in the manufacture of shuttles. (A communication.)

1952. J. W. Slater, Huddersfield, Yorkshire, manufacturer of mordants and colours. Improvements in the production of yellow and orange colouring matters.

1953. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in apparatus for preventing sea sickness. (A communication.)

1954. R. A. Brooman, 166, Fleet-street. Improvements in coke ovens. (A communication.)

1955. E. Watson, King-street, engineer, An improved apparatus, whereby screw propellers may be made to steer as well as propel, applicable also as an improved ball-and-socket joint.

1956. J. Platt, 10, Charlotte-street, Bloomsbury. Improvements in apparatus for supplying steam boilers with water.

1957. T. W. Guillod, 15, Park-place-terrace, Paddington. Improvements in the manufacture of chess boards and chess-men.

1958. E. Morewood, Stratford. Improvements in coating metals.

1959. J. Thompson and E. Gerrard, machinists, and F. A. Fitton, Ardwick, Lancaster. Improvements in engines for carding cotton and other fibrous materials.

Dated August 8, 1863.

1960. N. Jarvie and W. Miller, Glasgow, ropemakers. Improvements in the manufacture of oakum, and in apparatus therefor.

1961. W. B. Robins, Harborne, Stafford, actuary. A new or improved instrument or apparatus for extinguishing fires.

1962. J., T., A., and W. Thornton, Nottingham, manufacturers. Improvements in apparatus used for producing looped fabrics.

1963. A. P. Price, 47, Lincoln's-inn-fields, gentleman. Improvements in the application of india rubber and gutta percha to the manufacture of brushes and mats. (A communication.)

1964. H. R. Brown, Cranbourne-street. New or improved apparatus for the regulated delivery of cards, tickets, labels, bills, and sheets or pieces of cardboard, paper, metal, or other material, for advertising or other purposes.

1965. M. Smith, 71, Fleet-street, preserver. Improvements in obtaining farinaceous material from potatoes.

1966. J. W. Armstrong, Carmarthen, engineer. Improvements in fastening and in securing in position the rails of railways, the said fastening being applicable for other uses.

Dated August 10, 1863.

1969. B. Heyne, jun., Liscard, engineer. Improved apparatus to facilitate sketching and drawing landscapes, buildings, machinery, and other objects in correct perspective.

1970. R. Dickson, engineer, London Wall. Improvements in lithographic printing presses.

1972. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved manufacture of blue and of violet colouring matter. (A communication.)

Dated August 11, 1863.

1973. J. Robson, jun., South Shields, Durham, ironmonger. Improvements in money tills.

1974. E. S. Simon, 13, Bury-street. An improved fastening for leggings.

1976. W. Knowles, cotton spinner, and R. Halliwell, Bolton. Certain improvements in machinery for preparing, spinning, and doubling cotton and other fibrous substances.

1977. D. W. Barker, Anderlecht, near Brussels, Belgium, manufacturer of stuff goods. Improvements in means or apparatus for actuating rotary shuttle boxes.

1978. J. T. King, Liverpool, consulting engineer. Improvements in apparatus for containing and distributing gas for lighting railway carriages, steamboats, and other moveable vehicles and vessels, railway stations, and other places, parts of such apparatus being suitable for governing the supply of gas and air for various purposes.

1979. W. B. Haigh, Oldham, Lancaster, engineer. An improved equilibrium saw frame.

1980. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved process for hardening cast iron. (A communication.)

1981. J. G. Willans, Westbourne Grove Terrace. Improvements in the manufacture of iron.

1982. W. Clark, 53, Chancery-lane, engineer. Improvements in road sweeping machines. (A communication.)

1983. J. Wheeler, 23, Poultry, glove manufacturer. Improvements in the perfuming of gloves.

1984. W. Gray, Brownrigg, Haddington, North Britain, farmer. Improvements in certain parts of reaping machines, and in the working or application of the same.

1985. Sir J. S. Lillie, Knight and Companion of the Most Honourable Military Order of the Bath, 105, Pall Mall. An improved revolving battery.

Dated August 12, 1863.

1986. G. Graham, Manager of the Dalquhurn Turkey-red Dye-works, Dumbarton, North Britain. Improvements relating to baths or boilers used in dyeing.

1987. R. Mushet, Coleford, Gloucestershire, metallurgist. An improvement or improvements in the manufacture of cast steel.

1988. J. Cornforth, manufacturer, and A. Andrews, shoemaker, Birmingham. Improvements in the nails

commonly called screw rivets, which improvements are also applicable to other nails and spikes.

1990. R. Canham, Clerkenwell, foundry manager. Improvements in machines for the preparation of moulds for casting.

1991. J. Templeman, Glasgow, artificial fuel manufacturer. Improvements in the manufacture or production of artificial fuel.

1992. R. S. Newall, Gateshead. An improved mode of, and apparatus for, drying chemical compounds and other substances.

1994. W. Hudson, Burnley, gentleman, C. Catlow, overlooker, and J. Dodgeon, commission agent. Improvements in looms for weaving.

1996. W. Clark, 53, Chancery-lane, engineer. An improved lamp for burning coal oil and other similar hydrocarbons without the aid of a draught chimney. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated August 14, 1863.

2009. S. R. Wilmot, Brooklyn, United States. Improvements in hand trucks. (A communication.)

Dated August 15, 1863.

2020. P. F. L. B. Hirn, Le Cateau (Nord), France. A waterproof preparation to make fabrics, thread, textile matters, and others impenetrable against water.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, August 25, 1863.

907. T. Baldwin. Superheating steam.
931. M. Myers. Trunks, portmanteaus, and boxes.
935. G. T. Smith. Shutters.
946. W. Clark. Apparatus for the transport of goods. (A communication.)
947. H. A. Bonneville. Gas burners. (A communication.)
949. W. Spence. Manufacture of gunpowder. (A communication.)
950. H. Eaton. Presses for baling.
959. W. Oldfield. Construction of locks.
963. R. Knight. Treating and preparing iron, copper, and other wires.
968. R. H. Lawson and W. Darlow. Obtaining motive power.
970. C. Turner. Manufacture of felted fabrics.
975. W. B. Burden. Locomotive carriages and paddle-wheels.
978. P. G. Rowell and H. Holt. Securing the bands of locomotive engine and tender springs, also a new method of applying the same.
981. C. Blanc. Apparatus for the purpose of using air and steam as motive power.
985. A. Ford and R. Rigg. Reforming and reusing old or waste vulcanized india rubber.
990. M. Runkel. Marine steam engine governors. (A communication.)
992. H., E., S., and J. Yeadon. Healds.
997. W. Ryan and W. Daniel. Transmitting, equalizing, and registering human power.
998. F. E. Bryant. Ascertaining the temperature of steam and its power of tension. (A communication.)
999. T. Settle. Flyers.
1000. F. Durand. Moulding articles of china or other clay, or of other plastic materials.
1006. G. B. Barber. Steam boilers.
1013. P. McGregor. Spinning and doubling.
1015. J. B. Daines. Preparation of stone, plaster compo, iron, wood, and such like substances, so as to preserve them from decay.
1023. J. Thompson. Manufacture of barrels for firearms.
1024. J. Thompson. Machinery for punching metals.
1027. J. H. Johnson. Filtering apparatus for treating by pressure oils, syrups, and all sorts of liquids susceptible of filtering. (A communication.)
1053. F. Bennett. Condensing lead and other metallic fumes and vapours from furnaces.
1067. J. H. Johnson. Preserving property in case of shipwreck. (A communication.)
1089. W. Clark. Manufacture of hydrocyanate of ammonia and of alkaline and earthy cyanides. (A communication.)
1118. E. Chesshire. Intercepting the solid portions of the soil of water-closets.
1135. A. Sturrock. Locomotive engines and tenders.
1254. H. J. Olding. Treating flax and other fibrous plants.
1272. W. Nunn. Construction of signal lanterns or lamps.
1397. W. E. Newton. Construction of casks, barrels, kegs, and other analogous articles. (A communication.)
1445. W. Wells and J. W. Myers. Obtaining artificial light from volatile liquids or fluids.
1464. W. Sims. Compound extract to be employed as a means for the cure of deafness.
1543. T. Smith, T. Moore, and Major Burrell. Construction of reels covered with silk or other suitable material used as machines for the purpose of dressing flour.
1579. S. Robinson, J. Priestley, and J. Foulds. Looms.
1599. D. Hussey. Bobbins and the winding or roving of yarn thereon.
1610. G. Boccius. Manufacture of candles and other like articles.
1630. A. Silvester. Exhibition of dramatic and other like performances.
1640. J. and J. S. Harvey. Cutting tobacco.
1641. T. Taylor. Railway brakes.
1670. J. Oxley. Filtering apparatus.
1691. E. Myers and H. Forbes. Propelling and steering ships.
1710. P. G. B. Westmacott. Cranes and dockgate and other crabs.
1712. P. G. B. Westmacott. Hydraulic presses.
1881. W. E. Newton. Cartridges. (A communication.)
1899. A. R. Arrott. Bleaching certain vegetable fibres.
1915. J. I. P. Bonnett and J. Pfister. Lamps.
1954. R. A. Brooman. Coke ovens. (A communication.)
2009. S. R. Wilmot. Hand trucks. (A communication.)
2020. P. F. L. Bienvaux-Him. Waterproof preparation to make fabrics, thread, textile matters, and others impenetrable against water.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 21, 1863.

471. C. Malpas.
473. H. Kilshaw and T. Elce
474. F. J. Manceaux.
475. E. T. Hughes.
488. R. A. Brooman.
490. J. D. & A. P. Welch.
491. R. Martindale.
492. T. R. Harding.
493. T. and A. L. Dickens and H. L. Heywood.
494. J. Tatham.
498. W. and H. Whitehead and H. Barber.
500. J. Hawthorn.
503. J. W. Burton.
505. W. Hooper.
507. E. R. Walker.
510. J. Jilnger.
519. R. A. Brooman.
524. B. Lawrence and W. Niblett.
527. H. H. Henson.
531. N. Thompson.
533. A. Macivor.
534. G. Tompkins.
537. C. Ritchie.
539. W. A. Wilson and J. Smith.
541. A. P. Price.
542. J. Yates.
547. R. J. Nodder.
549. J. H. Albinson and H. H. Cocker.
550. W. Staufen.
552. E. T. Hughes.
553. J. Carver.
554. J. A. Coffey.
557. A. Dudgeon, G. F. L. Meakin, and E. E. Allen.
560. V. D. Delahaye.
564. W. Hadfield.
568. S. Williamson.
570. E. Paine.
571. T. E. Symonds.
574. E. Hayes.
575. S. Bateman.
585. J. S. Wells.
593. J. Henderson.
599. B. S. Cohen.
611. W. Clark.
617. J. Clinton.
639. D. W. Ransom.
661. A. Barclay.
669. A. Barclay.
694. J. Tangye.
797. J. Norton.
886. T. Gray.
1252. F. Fenton.
1409. A. J. Hollingsworth.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2016. M. Jacoby.
2033. J. H. C. Lacroisade.
2039. S. Greenwood.
2038. A. Halter, and F. Decorce.
2053. A. V. Newton.
2043. F. P. J. Van den Ouwelant.
2051. J., T., and G. Wilkes.
2144. G. Bedson.
2228. P. Pautard.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1952. J. Crossley and J. Bolton.
2046. E. P. Spiller.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending August 22, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
11	0 4	64	0 4	77	0 4	87	1 2	97	0 4	108	0 4
39	1 2	65	0 8	78	0 4	88	0 8	98	0 4	109	0 4
44	0 4	66	0 4	79	3 10	89	0 4	99	0 6	110	1 4
48	1 0	67	0 4	80	0 4	90	0 4	100	0 4	111	0 4
54	0 4	68	0 10	81	0 8	91	0 4	102	0 4	112	0 4
55	0 4	69	0 10	82	0 4	92	0 4	103	0 10	113	1 4
57	0 4	71	0 8	83	0 8	93	0 4	104	0 4	115	0 4
58	0 4	72	1 0	84	0 6	94	1 0	105	1 0	116	0 4
62	0 8	74	0 4	85	0 4	95	0 6	106	0 4	117	0 4
63	1 0	76	0 4	86	0 4	96	0 6	107	0 8		

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LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	p ct.
IRON:—					
Welsh Bars, in London	per ton	6 10 0	to	6 15 0	2½
Nail Rods	do	7 5 0		7 10 0	
Hoops	do	8 5 0		8 15 0	
Sheets, single	do	9 5 0		9 15 0	
Staffordshire Bars	do	7 10 0		8 0 0	
Bars, in Wales	do	5 10 0		6 2 6	
Rails	do	5 15 0		6 0 0	nett
Foundry Pigs, at Glasg, No 1	do	2 13 6		2 18 0	
Swedish Bars	do	11 10 0		12 0 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		0 0 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	99 0 0		0 0 0	
Hammered Bottoms	do	109 0 0		0 0 0	
Flat Bottoms, not Hamrd	do	112 0 0		0 0 0	
Tough Cake and Ingot	do	95 0 0		0 0 0	
Tile Copper	do	89 0 0		0 0 0	
Best Selected	do	98 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8¼		0 0 8½	
Fine Foreign	per ton	98 0 0		100 0 0	
TIN:—					
English Block	per cwt.	5 18 0		0 0 0	2½
do Bar	do	5 19 0		0 0 0	
do Refined	do	6 4 0		0 0 0	
Banca	do	6 6 0		0 0 0	
Straits	do	6 1 0		6 2 0	
TIN PLATES:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 6	
Second Quality	do	1 7 0		1 7 6	
Coke	do	1 3 0		1 4 0	
LEAD:—					
Pig, English	per ton	20 2 6		21 10 0	
„ Spanish Soft	do	19 17 6		19 10 0	
Shot, Patent	do	23 10 0		0 0 0	
Sheet	do	21 0 0		0 0 0	
White	do	27 0 0		27 10 0	

TIMBER, duty 1s. per load, drawback 1s.

	£ s.	£ s.
Teak..........load	£12 0	£13 0
Quebec, red pine	3 10	4 10
„ yellow pine	3 10	4 10
St. John, N.B., yellow	0 0	0 0
Quebec oak, white	5 10	6 10
„ birch	3 10	4 10
„ elm	3 10	5 0
Dantzic oak	3 10	6 10
„ fir	2 10	3 10
Memel fir	3 5	3 10
Riga	3 0	3 5
Swedish	2 10	2 15
Masts, Quebec red pine	5 0	6 0
„ yellow pine	5 0	6 0
Lathwood, Dantzic, fm	5 10	6 10
„ St. Petersburg	8 0	8 10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.		
Quebec, white spruce	15 10	18 10
St. John, white spruce	14 0	15 10
Yellow pine, per reduced C.		
Canada, 1st qual.	17 0	18 0
„ 2nd do.	11 0	12 0

Archangel, yellow	£13	
St. Petersburgh, yel.	11 10	
Finlan	9 0	
Memel	10 0	11
Gothenburg, yellow	10 0	
„ white	9 0	
Gefle, yellow	10 10	
Soderhamn	9 10	
Christiania, per C., 12ft. by 3 by 9 in.		
Christiania, yellow	21 0	23 0
Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 4
PUMICE STONE pr ton	5 10	9 0
OILS, &c.		
Seal, pale ...per tun	46 0	46 10
Sperm body	81 0	82 0
Cod	51 0	0 0
Whale, Sth Sea, pale	43 10	0 0
Olive, Gallipoli	60 0	0 0
Cocoanut, Cochin	48 0	0 0
Palm, fine	36 0	36 10
Linseed	44 10	0 0
Rapeseed Eng. pale	45 0	0 0
Cottonseed	33 0	40 0

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THE MECHANICS' MAGAZINE.

Contents of the Last Number.—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 4, 1863.

HIGH SPEED IN THE NAVY.

THE exploits of the "Florida" and "Alabama" convey too important a lesson to be lightly passed over. They afford an example from which much may be learned, much gained, if we please to profit by the information which their career — almost unexampled in the history of maritime warfare—supplies to the nation and the Government. We have here two steamers of small size, with light guns unprotected by armour, and with crews of, perhaps at most, a couple of hundred men each; doing an unparalleled amount of injury to an enemy's commerce and trade, burning and destroying wherever they please, and setting at defiance the entire Federal navy; fighting when so disposed, flying when occasion requires; intangible, vanishing from the grasp of the destroyer only to destroy. The characteristics of the "Alabama" are well known. The "Florida" is described as a "screw steamer of extraordinary swiftness; her hull long and low; no external traces visible of her real strength and power." It is stated on evidence, which we see at present no reason to doubt, that this little vessel had destroyed not less than 9,700,000 dollars worth of Federal property, up to the 11th of last May, and, most suggestive fact of all, she has managed to elude thirteen Federal cruisers sent specially in pursuit of her. Even if we take these statements *cum grano salis*, the mere fact of the "Florida" and "Alabama" being still in existence proves how difficult it is for regular men-of-war, to capture or destroy vessels whose great speed permits them to act the part of guerillas, the rapidity of whose movements prevents the acquirement of accurate knowledge of their whereabouts. The history of naval warfare shows unmistakeably that heavy frigates and ships of the line are totally unfitted to pursue and capture privateers; just as regular troops usually fail in operations undertaken against men who carry on a predatory, half-savage warfare—half-savage, in that each man acts more or less on his own responsibility, exposes himself to danger as little as possible, and invariably selects those moments when his enemy is off his guard as the best opportunity for making an attack.

In the face of such evidence, we continue to devote all our energies to the production of a magnificent fleet of iron-plated vessels, admirably suited for performing the weightier operations of warfare—ships which may probably add hereafter to the long list of sea battles in which England has been victorious. But we state without hesitation that these are not the vessels to cope with such craft as the "Alabama" and "Florida." The "Warrior" could not waste her time in looking for such ships. True, she might haply fall foul of one of them now and then, sink, burn, and destroy; but we imagine ships of the "Alabama" class would take particular care to keep at that safe distance which prudence dictated from our heavy frigates; and very little examination or inquiry is necessary to show that we have at present no other steam-ships built or building, really competent to undertake the destruction of such dangerous foes to commerce. It is folly to propose the despatch of a frigate costing over half a million sterling in pursuit of a craft not worth the tenth part of the sum: we may rest assured that recourse will never be had to such an expedient while it remains possible to avoid it. What the exact amount of destruction to our commerce may be which would render it impossible, we can form no idea; that it would be very considerable we have no doubt. Thus, in 1812, an American war brig, the "Argus," at one time took up her station off the south coast of Ireland, cruising between the "Tusker" and the "Saltee's," about the 1st of August. "The West India fleet now began to return, the ships of war leaving them at the chops of the Channel, and proceeding to Portsmouth. Now began the 'Argus's' destruction of the homeward-bounds. For several days and nights captures were made, and with their rich and valuable cargoes consigned to the flames, which were seen blazing and smoking as they drifted by. *No large ship of war could be spared at the time* for the Cork station." After doing an incalculable amount of mischief, the "Argus" was destroyed by the "Pelican" sloop of war, sent specially in pursuit of her. We are not a whit better prepared for such foes now than we were in 1812. It is not with gun-brigs we would have to deal in the event of a modern war, but with steamers whose speed would enable them to laugh our ships to scorn; and it is, therefore, well that the attention of those in power should be drawn to the necessity of providing a fleet of small steamers, specially constructed to encounter the privateers—for so we will term them—which a hostile Government would launch by the hundred against our mercantile marine.

The construction of such a fleet would entail little expense. Half-a-dozen serviceable war-steamers might be built, engined, and fitted for the price of the "Warrior;" but to be efficient, they would require to be extremely unlike any of the small sloops or despatch vessels we have now afloat. The first consideration must be speed. On this their powers of attack, their capabilities for making reprisals, and the facility for escaping when threatened by an overwhelming force, would entirely depend. Length would be necessary to ensure velocity; light draught of water to enable them to pursue, or fly, into shallows; a qualification which would seem to dictate a recourse to the twin-screw principle, or something analagous.

To cover such vessels with armour plates would be simply to render them useless. As a rule, they would have to contend only with ships as unprotected as themselves. They would no more attempt to encounter a modern frigate, than one of our 10-gun brigs of 50 years ago would a 120-gun ship. It might, probably, be found advantageous to fit them with a single strake of armour plates between wind and water; even this is doubtful, and should only be done after mature consideration. The question of armament is not one difficult of solution. A single 100 lb. rifled gun on Whitworth's, or some other principle equally good, and a couple of 68 lb. muzzle-loaders, would, we conceive, be amply sufficient. Did we possess any large guns perfectly trustworthy, they could find no place more suitable for the exercise of their powers than on the upper decks of such ships. The evils attending the discharge of the heaviest ordnance between decks, in comparatively confined situations, is well understood. In the open air, however, and with plenty of room to work them, their use would quickly become as habitual to the sailor as the carronade or the long 68; but, unfortunately, the success of any gun throwing shot over 100 lb. weight is too exceptional to enable us to calculate with certainty on their capabilities.

Masts and sails would, we conceive, be out of place in the ships we speak of. Depending wholly on their engines for the excessive speed which would really be the measure of their efficiency, spars would be of little service; and, being liable to be shot away, might foul the screw at the most critical moment. They are inimical to the attainment of speed, unless when going dead before the wind, or nearly so. It is very well understood that the top hamper of our steam frigates is a principal cause why they do not attain the speed of our merchant vessels; and ships intended to steam 17 or 18 knots an hour could not tolerate their retarding influence. It is generally considered that a steamer without spars would be powerless if her engines broke down. Perhaps; but there is no reason whatever that when placed in such a predicament she should not resort to the same expedient as a sailing vessel which had lost her masts—nothing would be easier than to stow jury masts, &c., so that they could be rendered available when occasion required. The absence of masts and top hamper would render a steamer burning Welsh coal, almost invisible at the distance of a few miles; one of the most desirable objects in the kind of warfare we are speaking of.

When we remember how light the armament necessary to these vessels would be, it is easy to understand that great size would be out of place. The real measure of their carrying capacity would depend on the size of their engines, and the quantity of coals stowed. 17 to 18 knots could be got in fair weather from vessels propelled by engines of some 3,000 effective horse-power. 800-horse power has been developed ere now by a 35 ton locomotive; and there is no reason that marine engines should be much heavier proportionately to their power. Screw engines and boilers, with water, of 3,000-horse power might, by a liberal use of steel, and wrought iron instead of cast, be so constructed as not to weigh more than 200 tons. Making every allowance, 70 tons of coal in the 24 hours would supply the engines with steam; and a cruise of eight days, nearly at full speed, would thus come within the powers of the ship. The mere fact, however, of a ship being able to steam 17 or 18 knots an hour, is no reason whatever that she should always run at that speed. The consumption of fuel increases as the cube of the velocity, and a very slight reduction in the number of knots steamed per hour would enable coal to be reserved for those moments when the engines would be exerted to the utmost. A powerful blower, arranged suitably, would double the evaporative power of the boiler at such a time. The mechanical engineer would experience no difficulty in constructing engines which, while very light, would be extremely trustworthy. Although run occasionally at the high speed for which they should be specially designed, their ordinary rate would be moderate, consequently repairs would not be heavy; and not only the engines but the ships could be refitted in almost any port on our coasts, as their moderate size would place them within the powers of any private ship-building establishment or engineering firm.

These war vessels would be admirably adapted, as well to afford a secondary protection to our own commerce as to destroy that of the enemy, while their comparatively trifling cost would deprive the loss of one or two, now and then, of any very serious consequences. We have not at present a single ship of the kind. The old steam-frigates of the "Bull-dog" and "Cyclops" class are fast disappearing, their slow speed rendering them utterly worthless. The all-absorbing subject of iron-plating has thrown every other question connected with

the Navy or the protection of our commerce comparatively into the shade, and our naval establishment will soon be composed of nothing but costly first-rates. That the construction of heavy war ships is of importance we admit; but that it is of an importance great enough to banish all other considerations we deny. A "Florida" or an "Alabama" may play havoc with our commerce to-morrow; and we feel pretty certain that our iron-plated frigates will be far too busily engaged to prevent them. The Government may, perhaps, contemplate taking up and arming our merchant steamers in the event of a war. The evidence given before the House of Commons some 14 or 15 years ago, was scarcely sufficiently encouraging even then to warrant any great reliance on the aid to be derived from such a force; there is not a ship of the kind which would not require immense strengthening before she could be considered fit to carry one or two 68-pounders, and war might be half-over before they could be qualified to take any part in it. To be at peace, let us be prepared for every description of naval attack and defence. A few hundred thousand pounds, properly laid out now, may possibly prevent the loss of millions hereafter; and our readers may rest assured that the question we have placed before them is one of vital importance, well worthy the careful study of thinking men.

LOCOMOTIVE IMPROVEMENT.

The locomotive engine appears to have arrived, two or three years ago, at that point in its history where improvement ceased, at least, for a time. There is nothing remarkable in such a fact, which is common to every description of machinery. Any one who will take the trouble to compare Stephenson's "Rocket," now preserved in fair order at the South Kensington Patent Museum, with the engines of the "Planet" class, one or two of which have been treasured up by the North-Western Railway Company; and these, again, with the engines of the long-boiler variety, with outside cylinders and forked connecting rods, many of which are still working—will see how great has been the march of improvement which has developed the magnificent machines exhibited last year, from such imperfect examples of engineering skill. It is not at all strange that we should rest content for a time with what has been accomplished within the last thirty years; but it would be very erroneous to conclude that this pause is likely to last, or that it arises because the locomotive holds out no inducement to the engineer to exert himself further in developing its powers, increasing its economy, or adding to its durability and efficiency. There is a certain point in the progress of every machine when it performs its duties so well, that any attempt at further improvement holds out little prospect of pecuniary reward; inventors pass it by then, turning their attention to something which more obviously requires the exertion of their peculiar talent. The locomotive is pre-eminently a machine of this class, being really so far perfected that nothing but the refinement of mechanical skill can add to its merits. The reward for such improvements may not be great to the inventor, but they cannot fail to be to railway companies; and although there is no great field for outsiders, there is for locomotive superintendents and others, who have it in their power to introduce those little matters of detail, which, seemingly very trifling, really conduce in a superlative degree to the efficiency of the machine.

The introduction of good coal as a substitute for coke has become almost universal on all the railroads in Great Britain, the saving effected being very considerable, amounting to many thousands per annum on such lines as the North-Western. All things considered, the production of smoke from coal-burning engines is not very great, and with a little more care might possibly be reduced to half what it is at present. Even now, however, it can scarcely be considered a nuisance, except by the fastidious. With a roomy fire-box, and a free admission of air above the fire, almost any coal can be burned without smoke. It is not easy to secure these conditions, however, in the locomotive. The furnace doors are far too small to supply all the air required if perforated ever so closely on Wye Williams' principle; and their fire-boxes are too confined to permit flame to exist in them as freely as it ought. Theoretically the gases should remain in the box till consumed, a condition impossible to secure completely. The scoop deflector has been introduced as a substitute for the perforated fire-door, and the brick fire-bridge to detain the gases and aid their combustion. These, combined with a long grate and a deep fire-box, give better practical results than can be derived from the use of the combustion chamber, which is rapidly going out of favour. The employment of this expedient — to designate it by its proper name—entails a shortening of the tubes, which is fatal to economy, and materially hastens the destruction of the smoke-box and stack. An increase in their number, and reduction in their size, as practised at one time on the East Lancashire line, where 427 tubes of 1¼ in. diameter were crowded into a shell of but 3 ft. 8½ in. outside diameter, has given anything but good results, either in the economy of fuel or the durability of the boiler. Mr. Williams and many others have endeavoured, ere now, to prove that length of tube was superfluous, inasmuch as experiments showed, that evaporation was almost wholly confined to that portion of the tube surface next to the fire-box. Most of these experiments were made with model boilers, employing gas jets to produce the necessary heat. The results obtained were fallacious. We have every reason to believe that a locomotive boiler with 2-in. tubes evaporates a very considerable quantity of water close to the smoke-box when travelling at a high speed. It is taken for granted that flame will not enter a 2-in. flue for any considerable distance; this is perfectly true with a moderate draught. When the fire is urged, however, by the powerful action of the blast-pipe at high speed, such flues become filled with flame from one end to the other if not more than 8 or 9 feet long. Any engineer can determine the fact for himself by drilling a few sight holes in the smoke-box door. It is well known that by exposing a Davy lamp to a strong current of air, flame will be forced through the wire gauze, and accidents have ensued ere now from this cause. Flame will not enter small tubes from precisely the same reason that it will not pass the gauze meshes of the lamp; but the opposing force can be overcome without difficulty, and nothing is easier than to compel flame to enter and traverse a tube of moderate diameter. How much smoke may be consumed (to popularize the action which takes place) within the flues of a locomotive boiler, is a subject well worthy of careful inquiry. Large and long flues may, after all, be quite competent, when aided by a roomy fire-box, to supply all the space necessary for tolerably perfect combustion, without entailing any of the difficulties which beset the combustion chamber, and as experience proves without any risk of wasting fuel; for more heat is lost in permitting the escape of unconsumed gases through small flues, than can possibly follow from the use of large flues, which, although they offer less heating surface, yet render that surface more valuable by permitting the existence of flame within them.

Though locomotives consume the products of combustion moderately well, we have no reason to conclude that their efficiency, or the economy of fuel burned, is as yet anything like what it should be. The average evaporative duty of the locomotive boiler does not much exceed 8 lb. of water converted into steam, for each pound of coal put into the fire-box. Lord Dundonald succeeded, years ago, in evaporating nearly 13 lb. of water, for each pound of coal consumed, in a marine boiler not of the best type—a result generally attributed to slow combustion. Experiments conducted in France, however, fail to confirm such a conclusion, as the employment of a forced draught, with quick combustion, was proved beyond dispute to add equally to the efficiency and economy of a boiler properly constructed, though not specially intended for the employment of the principle. The straight sides of the locomotive fire-box—or, worse still, those which are wider at the top than at the grate—are extremely unsuitable for communicating heat to the water surrounding them. A vertical surface is certainly not more than half as efficient as one steeply inclined over the fire, a film of steam remaining continuously in contact with the plate, and preventing that absolute contact of the water with it which is essential to the rapid production of steam. Mr. Sinclair, of Glasgow, constructed the fire-boxes of some of his small locomotives with inclined sides with the greatest advantage, and the principle deserves general adoption. It reduces the size of the tube-plate, however, so much, that in order to carry it out as it should be, grates must be made much wider than they now are—a difficult job on the narrow gauge, from the position of the trailing and driving wheels. Anthracite coal-burning engines have been successfully constructed in America with grates 7 ft. wide across the track, and as much as 6 ft. long. Were such enormous grates adopted here, it might be found advantageous to cover them round the sides with fire-bricks, which would protect the plates and conduce materially to the regular production of steam. A thinner fire, too, might be maintained on the grate with manifest advantage, as far as the prevention of smoke is concerned.

The feed-pump is rapidly being displaced by the injector. On the North-Western it is only retained on a few old-fashioned engines, as much, perhaps, for the purpose of comparison as from any other reason. A feed-pump, filled with air-vessels and all the requirements necessary to hydraulic machinery, driven at a high speed, is really rather a complicated piece of machinery, easily put out of order, and exposed to risk from frost, &c. We understand that on the Eastern Counties line, where the application of the injector is all but universal, a very considerable saving is effected in the item of feed-pipes alone. Not one has ever burst when the injector is employed, while with feed-pumps of the best construction they were continually being ruptured, either by the irregular action of the pump or by frost. The engines, too, are found to keep their steam better when running, if the boiler is fed by the injector than when supplied by a pump. There is little doubt that the expenditure of steam is far greater with the former for equal quantities of water fed in than with the latter; but this really is a matter of very little consequence when we consider the advantages held out by the injector. The simplicity of its arrangements, the ease with which it can be fitted

and, we may add, the certainty of its action under all the varying circumstances to which a locomotive is exposed, render its application one of the most important improvements the locomotive has received of late years.

BRITISH ASSOCIATION.

Mechanical Section.

AIR-ENGINES AND AIR-COMPRESSING APPARATUS.

Mr. J. Jameson, Close Engine Works, read a Paper on "Air Engines and Air-compressing Apparatus" in which he pointed out that in the steam-engine not more than one-seventh of the total consumption of heat was utilized, and then proceeded to enumerate the causes of the non-success of the air-engines which have hitherto appeared, referring to two as types of the whole. In the first, he showed that, in addition to the heat required to work the engine, there was a consumption of heat in the hot chambers of the generators, resulting only in the development of heat in the cold chamber, which actually resisted the action of the engine; that this absorption and development of heat acted in three ways—first, in absorption, by diminishing the working pressure; next, in its development increasing the resistance; and, thirdly, in interfering with the action of the respirator. He also stated that the necessity existing for keeping all parts of the machine at once in motion resulted in a loss of effect, represented by two to four cubic feet for every foot of air contained in the working cylinder at the best point of the stroke, and he said that the operation of these causes necessitated the employment of excessive heat or very low speed, an almost fatal alternative. The second type of air-engine, he said, required the employment of extremely large apparatus, because there was a pressure diagram and a resistance diagram caused by the working of a pump, and the total diagram must always, therefore, amount to three times the effective diagram. In the air-compressing apparatus he described that the defects he referred to were obviated by the fact that there is no transference of heat from the hot to the cold chambers, but that the total heat absorbed in the hot chamber was converted into mechanical effect, and, therefore, a lower degree of heat might be employed; that there is no difficulty in the arrangement from cushioning in the working cylinder; that the highest point of pressure obtained in the generator is not again lost, as it is in all other cases; and that, in addition to the improvements effected on the first type of engine he described, the new apparatus is capable of receiving the whole effect obtainable by the use of the second form of apparatus, and without its resistance, and at high instead of low pressures. He finally referred to the advantages to be derived from the use of air instead of steam, which he stated to be a saving of fuel; freedom from risk of explosion, bursting under air pressure being comparatively harmless if it should occur; but he stated that no safety-valves were required in the apparatus decribed by him, as it was self-governing in the production of pressure: it was not liable to disarrangement—would work reversed as well as forward. Insurance was not affected by the use of the engine, and the compressed air might be applied in any situation, be laid on like gas, to be used when and how it was required. He stated that power might be applied in this way to a whole town, at a cost infinitely less than the cost of the present method, and with other advantages which required no comment.

Mr. Siemens said that the use of four generators was a disadvantage, resulting in four losses of heat; that he apprehended the curves of the diagram exhibited did not follow the law of the dynamical theory of heat; that the effect of cushioning was an obstacle that Mr. Jameson did not appear to allow for; that the loss of effect by cooling was considerable; and that he apprehended the necessity of a full red-heat to produce the effects described, and the more so because the heat in the cold chamber required a double heat in the hot chamber to compensate for it.

Mr. Jameson replied that four generators were only drawn for illustration of the principle, but, practically, he in no case used more than two. That the point of the curves bearing upon the question at issue were the end points, and unaffected, so far as the illustration went, by Mariott's law; that the case referred to was change of temperature amounting to 500 degrees, in which 20 degrees were allowed for cushion. But that cushion did not exist in the apparatus he had described except in an infinitely mall degree, and, consequently, a heat much below ed was required to produce a double expansion; that the cooling effect referred to by Mr. Siemens was an effect for which waste heat would entirely compensate, as it occurred in a part of the apparatus quite separated from the generators; and that, as far as the effect of heating in the cold chamber was concerned, the apparatus possessed the important advantage, by means of double valves, of enabling the air passing from one generator to another to be cooled, whereby the cold chamber remained in an efficient state at all times.

A Member said he had been working once with the the inventor of the moderateur lamp, Mons. Blanche, at an apparatus for a similar purpose, and they found a disappearance of pressure of a very remarkable character. He also apprehended great inconvenience from the introduction of a reservoir, as all empty space in air-engines was most injurious.

Mr. Jameson said that he had not found any disappearance of pressure for which he could not account by defective joints, and, by a peculiar construction of joint, he was able almost entirely to prevent leakage; and also explained that the reservoir he had introduced being separated from the generators by a valve which only opened when the generator pressure exceeded the reservoir pressure, entirely prevented any injurious effects from arising in the way indicated.

Prof. Pole, F.R.S., said he would be glad to hear of some results.

Mr. Norman Cookson, Newcastle, explained that several engines had been built, one of which, indicating 3½ horse-power, could be maintained in action for 10 hours with 70 lb. of coal; that a smaller one of half that indicated power required nearly the same quantity of coal, simply because the fire could not be kept alight with much less.

Mr. Spencer said Mr. Jameson had modestly stated the consumption of heat in steam-engines to be seven times the effect. He might have said fourteen times. He was very glad to see an effort to convert heat directly into mechanical effect. He hoped it would be persevered in, and had no doubt there would be a result.

[We understand the engines selected by Mr. Jameson as the types of the whole were those mentioned the previous evening by Sir Wm. Armstrong.]

REGENERATIVE GAS-FURNACES.

Mr. C. W. Siemens read the following Paper on these ingenious pieces of machinery:—

The principle of the regenerative gas furnaces has already been explained to the scientific public, by Professor Faraday, in a lecture delivered by him at the Royal Institution in June, 1862. Its general construction and the history of its invention and gradual development form, moreover, the subject of a Paper which was read by me in January, 1862, before the Institution of Mechanical Engineers. Since that period this principle of heating has been extensively applied in England, France, Germany, and other countries to glass-houses, for heating gas retorts and muffles for metallurgical purposes, for melting steel, and for puddling and welding iron. The ostensible object of this invention being to save fuel, it could hardly be expected that it would be favourably looked upon in this, the greatest coal-producing district of the whole world; but experience has proved that there are other advantages resulting from its application which, in the case of puddling and working iron, are even superior in value to mere saving of fuel in a money point of view. A diagram was exhibited representing a furnace for welding and working iron, and the gas-generator connected with it. The heated chamber is of the usual form, but instead of a fireplace there are four passages (two at each end of the chamber) leading downwards into four regenerators or chambers filled with loosely piled fire-bricks. The lower extremities of these four regenerator chambers communicate with two cast-iron reversing valves. The gas arriving from the producer through a pipe is directed by the valve into one regenerator or other according to the position of the valve. The gas then ascends through the one regenerator, where it takes up the heat previously deposited in the brickwork, and issues into the furnace at a point where it meets with a current of heated air arising from the second regenerator to effect its combustion. The products of combustion pass away through the opposite regenerator and the reversing valves into the chimney flue. The last-named regenerators receive at this time the waste heat of the furnace, heated at their upper extremity to the temperature nearly of the furnace itself, but remaining comparatively cool towards the bottom. Every hour or half-hour the direction of the currents is reversed by a change of the valve lever, the heat before deposited in the one pair of regenerators is now communicated to the air and gas coming in, while the waste heat replenishes the second pair of regenerators. The gas producer consists of two inclined planes upon which the fuel descends, being gradually deprived in heating of its gaseous constituents, and finally burnt to carbonic oxide by the air entering through the grate at the bottom of the inclines. Water admitted at the bottom also assists in the decomposition of the ignited coke at the bottom, converting the same into carbonic oxide and hydrogen gas. The saving of fuel which has been effected by this arrangement amounts to from 40 to 50 per cent. In the application to reheating and puddling furnaces a saving of iron has been effected, owing to the mildness of the gas flame, of from 3 to 4 per cent. of the entire quantity put in; the iron also welds more perfectly than it does in the ordinary furnaces. Smoke is entirely obviated. By another arrangement the regenerative principle has been applied also to coke ovens, the result being that the separation of the coke from its gaseous constituents is effected without losing the latter. In placing the coke ovens, constructed on this plan, near the works where the iron is puddled and reheated, the latter operation may be entirely effected by the gas generated in producing the coke necessary for the blast furnace in producing the pig iron. The gas resulting from the regenerative coke oven may be used to heat the blast, and boilers connected with the blast furnace. These latter improvements are now in course of being carried into effect on a large scale. The gas produced from the last-named producers is of a very illuminating character, and may, it is repeated, be used for that purpose in preference to the hydrocarbon now manufactured for that purpose by a much more expensive process.

RICHARDS' STEAM INDICATOR.

Mr. C. T. Porter, London, read an excellent Paper on "Richards' Indicator for Steam Engines." He had much pleasure in announcing that arrangements had been made at Messrs. R. Stephenson and Co.'s by which one of these indicators would be in use upon their engine during the meeting of the Association, where it might be seen in operation from 2 until 6 o'clock each day of the meeting. A model of the instrument and diagrams illustrated the contents of the Paper.—A vote of thanks was carried to Mr. Porter for his excellent Paper.

Mr. Thompson, Belfast, was of opinion that this indicator was evidently a step in the right direction.

Mr. Oldham, of Hull, inquired what was the difference of price of this instrument as compared with the ordinary one. He saw that it was made by Elliott, of London.

Mr. Porter said it was. The price was £8 10s. As compared with the smaller cylinders made by other well-known makers, the price of this instrument was rather higher, but not so high as those for the same area of cylinder. The Messrs. Elliott had calculated not to manufacture any instrument smaller than half of a square inch. They would, however, receive special orders for special instruments.

Mr. Robert Mallett, C.E., London, said he had seen the indicator in use in the Great Exhibition at London, where it was applied by Mr. Porter to his own engine. Nothing could exceed the beauty of its action when indicating a high-pressure engine when working at a speed of 600 or 700 ft. a minute.

Mr. John Fernie, Derby, spoke in terms of commendation of the instrument, which he had seen in use both in the Exhibition and also at Messrs. Stephenson's.

Mr. J. F. Spencer, Newcastle, referred to the ordinary form of indicator, pointing out its defects, which this instrument remedied.

IRON SHIPBUILDING.

Mr. C. M. Palmer, of the Jarrow Works, read a long and elaborate Paper on "Iron Ship Building." After a few preliminary observations Mr. Palmer said:—

The principal advantages claimed for ships of iron, as compared with vessels of timber, are briefly these:—In vessels of 1,000 tons the iron-ship will weigh 35 per cent. less than the timber vessel, the displacement of water being the same. The iron ship will, therefore, carry more weight, and, as the sides are only about one-half of the thickness, there will, consequently, be more space for cargo. The additional strength obtainable, too, allows iron ships to be built much longer and with finer lines, thus ensuring higher sailing or steaming qualities, with greater carrying power,

and, therefore, greater commercial results. In wooden vessels repairs of ruinous extent are frequently required, while the repairs in iron ships are generally of a lighter character, and are only needed at long intervals. An iron ship is not liable to strain in a heavy sea, whereas the straining of a timber vessel often damages a valuable cargo. The bilges of an iron ship can be kept clean and free from the disease-engendering bilge-water which is always found in a wooden ship. Moreover, the use of iron masts, steel yards, and wire rigging effects a very large saving of weight, and affords the greatest facilities for the application of patent reefing sails, and other appliances, by which economy of labour is attained, and many risks of loss of human life avoided. As to the form of building iron ships, and the manner of combining the iron so as to obtain the requisite amount of strength with the least amount of material, much difference of opinion exists among practical men. The angle iron frame and plating of the iron vessel take respectively the places of the timbers and planking of the wooden ship; and it has been found by experience that plating one-eighth of an inch thick is equivalent in effect to planking of oak one inch thick, while plating 11-16ths of an inch thick is equal to planking of oak 5 in. thick. As in the largest American wooden vessels, the plank is seldom more than 5 in. inches thick, so it may be argued on the above data that the plating of the largest iron ship need not be more than 11-16ths thick; and any strength required above that which such plating would give should be obtained by means of framework. Many practical men, however, advocate the system of light framework, and, in order to obtain the measure of strength necessary, the application of thicker plates. That the principle of strong framing and plating of moderate thickness is most advantageous may be shown by many facts other than those which are derived from the most modern practice of wood shipbuilding. The strength of an iron ship, as in a girder, depends on its capability to resist the buckling and tensile strains that it is called on to bear. But I believe that we have, in reality, only to make a ship strong enough to resist the buckling strain; and I am led to this conclusion by experiments conducted for that celebrated work, the Britannia Bridge, which proved that in constructions of wrought iron the resistance to the tensile strain is much greater than their resistance to buckle, and, in consequence, the upper part of the girders are made much stronger than the lower part. We have, in my opinion, to make the parts of an iron ship, in principle, like a girder. A girder, however, is at rest, and the strains are always in some known direction; but in a ship, the position of which is ever varying, it requires to be so conducted as to resist the strains in such varied positions. If the side of a ship could remain as in a girder, constantly vertical, then the advocates for the thick plates and small frames might be able to show that their system was the most economical way to obtain the requisite strength; but, as such side, if laid over, as it is in a ship at sea, would, without support, bend or buckle of its own weight, it is evident that the framing is absolutely necessary to keep the plating firm in position, and consequently the strength of the ship depends in a very great degree on the strength of the framing. Another fact that shows the economy of strong frames is that a plate, with a piece of angle iron attached to its edge, would bear much more before buckling than a similar plate increased in thickness so as to weigh the same as the plate and the angle iron. But the great and most important argument in favour of moderately thick plates and strong framing is that all the work must be put together by hand; for, though many attempts have been made to rivet ships by machinery, none seem yet to have been successful even in a mechanical point of view. So soon, therefore, as the thickness of plates and the size of the rivets pass the point at which the workman with ordinary exertion can accomplish good work, then the attachment of the parts by means of rivetting is subject to the risks of imperfect workmanship. It is, therefore, my opinion, both in a practical and theoretical point of view, that we ought not to use plating in any vessel, however large, more than about three-quarters of an inch in thickness.

Mr. Palmer next gave some account of iron shipbuilding in the Tyne, Wear, and Tees from 1842, when the first iron steamer—the "Prince Albert" —left the Walker slipway, to the present time. The competition of the railways in the carriage of coals gave the first great impetus to the building of screw colliers; and from 1852, when they first began to be employed in this trade, 5,212,713 tons of coal have been carried to London by them. Since its first introduction, too, the screw collier has been greatly improved, and the facilities for loading and discharging very largely augmented. The screw collier "James Dixon" frequently receives 1,200 tons of coal in four hours, makes her passage to London in 32 hours, there, by means of the hydraulic machinery which the President invented, among the other inventions which distinguish his name, discharges her cargo in 10 hours, returns in 32 hours, and thus completes her voyage in 76 hours. The "James Dixon" made 57 voyages to London in one year, and in that year delivered 62,842 tons of coal, and this with a crew of only 21 persons. To accomplish this work on the old system, with sailing colliers, would have required 16 ships and 144 hands to man them. Proceeding to the subject of iron ships of war, Mr. Palmer said :—

The first iron vessel for war purposes constructed in this district was the "Terror," one of the large iron-case floating batteries designed during the Russian war to operate against Cronstadt. This vessel, of 2,000 tons, 250-horse power, carrying 26 68-pounder guns, was built in three and a-half months, and she would have been completed in three months had not the declaration of peace slackened the energies of our men, which, up to that time, had been maintained so nobly by their patriotic feelings. It was in the building of this vessel that rolled armour plates were first used. The demand for forged armour plates was so great that the forges of the kingdom could not supply it, and recourse to rolling was unavoidable. At the time the largest plate mill was at Parkgate; and we accordingly employed Messrs. Beale and Co., the owners of Parkgate Works, to roll the plates we required. To the use of these rolled plates, however, the Admiralty opposed itself; but we feeling convinced, by experiments which we made, that the rolled armour plates were at least equal to the forged, invited the Admiralty to a trial of their efficiency. We built a target 9 ft. square, on a plan which we thought might be advantageously adopted for large vessels of war, and on the cellular principle. The cells we filled with compressed cotton, which we had found by experiment to be very effectual in stopping shot. On this target was a thin teak backing, and on the teak were bolted one hammered and two rolled plates. The target was bolted on to the side of an old wooden frigate at Portsmouth, under the direction of Capt. Hewlett. The first shot fired at it missed the target, went through both sides of the frigate, and, to my great astonishment, skimmed over the surface of the water for nearly a mile. The firing showed that while the hammered plate split and cracked to pieces, the rolled plates were not broken—only indented—and were superior to the hammered plate in every respect. Unfortunately the target was not firmly bolted to the vessel, and it sprung at each shot, so that the bolts which held the armour plates were broken, and they fell into the sea. A shot was then tried to test the resisting power of the compressed cotton, and it appeared to answer so well, that Captain Hewlett advised a series of experiments to be tried. The Admiralty were willing, but required us to provide the targets at our own expense. Having already spent upwards of £1,000 on experiments for the good of the country, we declined this proposal; nevertheless, we had proved to the Admiralty this important fact—that the rolled plates were superior to the forged, and they have since been universally adopted. We claim, therefore, for this district the honour of being the first to prove the strength and utility of rolled armour plates, since known and spoken of in Parliament as "Palmer's rolled plates."

Having expressed his opinion that the "Defence," built in his yard, did not from her peculiar model combine all the strength which might have been obtained with the same weight of material, and given a few details of the extent of his own works as a sample of the development of our manufactories, Mr. Palmer, in conclusion, said :—

A consideration of the future of the iron shipbuilding trade opens out a vast field for speculation; but the ultimate result is not difficult to anticipate. We have seen with what success sailing vessels have been superseded by steamers in the coasting and coaling trade, and we know that magnificent fleets of steamers engaged in the postal and other services are ploughing almost every known sea. As commerce increases there will be few trades in which the employment of iron steamers will not be found of advantage. Most of the carrying trade to the Baltic and Mediterranean is already conducted in vessels of that class, and the sailing ships that cross the North Atlantic are being rapidly displaced by iron steamers. Their advantages in strength, speed, and capacity are so marked that sailing vessels of timber must give way before them. Even the Admiralty, cautious and unyielding though it be, will have to abandon its "wooden walls" in favour of the stronger and more useful material—a material, too, that lies in rich profusion beneath our feet, and has not, like timber, to be purchased of other nations. The commercial men of this country have set the Admiralty a signal example of industry and enterprise. It is they who have made the experiments and adopted the inventions that have established the maritime supremacy of this country; and it is owing to their energy that we find on every sea, in the shallow rivers of the East, and the deep, broad waters of the West, English-built ships of commerce diffusing the benefits of free trade, and linking nations and tribes together in the bonds of amity and peace. The true source of our national greatness is to be sought in this wonderful development of our merchant navy. Other nations are entering into friendly rivalry with us; but the larger share of the carrying trade of the world will ever be secured to that country that can produce vessels combining the largest capacity with the utmost amount of economy and expedition in construction, and that can, at the same time, navigate those vessels with the greatest degree of skill and rapidity. The mineral wealth of this district, and the skill and endurance of its workmen, whether on land or sea, will, I feel convinced, enable the locality that gave birth to an Armstrong and a Stephenson to maintain its character for maritime industry and enterprise, and bear its full share in promoting the commercial greatness of the country.

DEPOSIT IN BLAST FURNACES.

Mr. J. Pattinson read a short Paper on a deposit found in the waste gas tubes of blast furnaces smelting Cleveland ironstone. It was as follows :—

A substance, in fine powder, varying in colour from blackish grey to almost white, is deposited in the large tubes used for conveying the waste gases of iron smelting furnaces to the boilers and heating stoves, where they are economized. Some of the constituents of this deposit are doubtless volatilized by the intense heat of the furnace, whilst others are merely carried over mechanically by the current of the gases. In the waste-gas tubes of the furnaces in which Cleveland ironstone is smelted, this deposit accumulates in such quantity as to necessitate the cleaning out of the tubes every three or four months. It also adheres to the bottoms of the boilers and to the heating stove pipes, from which it has to be occasionally removed, as it materially prevents the conduction of heat. So far as I am aware, no analysis of this substance has yet been published. It appeared to me that such an analysis would be interesting, as pointing out the nature of the substances volatilized in such quantity by the action of the blast furnace. The sample selected for analysis was obtained from the waste-gas tube of a furnace belonging to Messrs. Gilkes, Wilson, Pease, and Co., of Middlesbro'. In order to avoid as much as possible the presence of particles of dust carried over mechanically, the sample was taken from under the side of the tube, at a point distant about 140 ft. from the furnace. A mixture of Upleatham and Rosedale ironstones, with Weardale blue limestone and South Durham cokes, had been smelted in the furnace for some considerable time previous. The deposit was of a dark grey colour, and was impalpably fine powder. On analysis, it was found to contain as follows :—

Protoxide of iron	14·22	per cent.
Oxide of zinc...	10·8	,,
Sulphate of zinc...............	13·70	,,
Alumina	8·20	,,
Lime..............................	12·32	,,
Magnesia	5·03	,,
Chloride of sodium	4·74	,,
Ammonia	0·70	,,
Thallium	trace.	
Sulphuric acid..................	3·18	,,
Free Sulphur	0·17	,,
Silica..............................	26·60	,,
Carbonaceous matter.........	4·50	,,
	99·84	

The portion soluble in water had a slightly acid reaction, probably owing to sulphate of zinc, which was found to be present to the extent of [illegible] per cent. It also contained sulphate of lime, sulphate of ammonia, and chloride of sodium. A very small portion of the alumina and silica are dissolved [illegible]

boiling with solution of potash; from which fact, together with the acid reaction of the portion soluble in water, it is inferred that the most of the alumina, lime, and magnesia are in chemical combination with the silica. Sulphuretted hydrogen is copiously evolved on the addition of hydrochloric acid, but not at all on the addition of hot acetic acid; and about 10 per cent. of oxide of zinc is dissolved by caustic potash. It is, therefore, concluded that the sulphide present is sulphide of zinc. The source of the zinc is doubtless the ironstone, as small pieces of zinc blude are occasionally found in the mines, and I have detected its presence in minute quantity diffused throughout the mass of ironstone. Thallium was detected by means of the spectroscope. A portion of the deposit held on a platinum wire in the flame of a Bunsen burner gave faint but unmistakeable indication of the presence of this metal. An attempt was made to estimate the amount by treating about 1,700 grains according to Mr. Crooke's method of separation; but although the amount obtained in this manner gave greatly increased indications of its presence in the spectroscope, yet there was not a sufficient amount obtained to make a quantitative estimation. I am inclined to think that the thallium is not derived from the ironstone, but has had some other source, and that its presence in this sample is accidental, as I have examined various other samples of flue deposit, both from furnaces smelting Upleatham and Rosedale stone, as well as from furnaces using stone from other Cleveland mines, for the purpose of detecting the presence of this substance, but without success.

STEEL.

Mr. T. Spencer read the next Paper, which was as follows:—

The history of the manufacture of steel in this locality commences at a very early period; for we find that, probably 300 years ago, a colony of Germans settled at a place on the river Derwent, within a few miles of this town, and, according to tradition, there established this branch of local industry, where they also attained some celebrity as manufacturers of swords and edge tools. The names of these immigrants who, it is stated, took refuge in this country, that they might enjoy religious liberty, were Ole, Mohl, Voos, &c., &c., and some of whose descendants still reside in the village where their ancestors originally settled, the names being now Anglicised to *Oley*, *Mole*, &c. The name of this village is Shotley Bridge, and in the wall of an old two-storey dwelling-house, the original materials of which are hidden under a coat of "rough-cast," there still exists a stone above the doorway with an inscription in bad German, to the following effect: —DES. HERREN. SECEN. MACHET. REICH. OHN. ALLF. SORC. WAN. DVZVGLEICH. IN. DEINEM. STAND. TREVW. VND-LLEISIC. BIST. VND. DVEST. WAS. DIR. BELOHLEN. IST. 1691, of which the following is a free translation, showing that the original importers of the steel manufacture to the district were probably good Lutherans, who had suffered persecution for conscience sake:—"The blessing of the Lord makes rich without care so long as you are industrious in your vocation and do what is ordered you."

But there is a much earlier record of these German immigrants than the above; the parish register at Ebchester church containing the following entry, by which it will be seen that the name even then had undergone a change:—"Elliner, the daughter of Mathias Wrightson Oley, was baptized on the 17th day of June, 1628;" and shows, also, that the grandfather of the child then baptized had probably married into a family of the name of Wrightson, at that time resident in the neighbourhood, as appears by several entries in the parish register of the period, clearly marking a third generation.

In all probability the next works of this nature established in this locality were those of Sir Ambrose Crowley, who is described as an ironmonger, and afterwards Alderman and Lord Mayor of the City of London, and who appears to have commenced a manufactory at Winlaton Mill in the year 1691. The names of Landells and Chambers are mentioned as being in this trade at an early period, after whom came Cookson, Spencer, and others, whose works are carried on at the present time.

The manufacture of steel, as at present carried on in this district, comprises the following descriptions:—Blistered, shear, spring, and cast steel, to produce which the following materials are required: iron, carbon in the shape of charcoal, manganese, coal, coke, fire-bricks, and fire-clay—of these the iron and manganese are imported into the district, the former for the best qualities of steel being brought from Sweden. The charcoal, coal, coke, fire-bricks, and fire-clay are produced in almost inexhaustible quantities and of most excellent quality in the immediate neighbourhood: a small proportion of fire-clay, however, having to be brought from a distance for admixture with that found in the locality.

The mode of manufacture in use here is that known as the cementing our converting process, the furnaces used being large enough to contain from 10 to about 23 tons of materials at one time; this material consists of selected iron, and known to the manufacturer as being most suitable for the purpose for which it is ultimately intended. It is placed in the cells of the furnace with bruised charcoal in alternate strata, the whole being covered with a vitreous material to effectually exclude the air, and heat is applied for a period of about eight or ten days, according to the degree of carbonization required. The mass is allowed to cool for several days, and the bars are then taken out in the form of blistered steel. The change that has taken place in its structure, since it was placed in the converting furnace is very marked, for instead of now being of a fibrous nature it is quite of a crystalline character, and it must be reduced or drawn out under rolls or heavy hammers to bring back to it something of its former nature. It is, however, used in the blistered state for many purposes, such as for welding into hammer faces, and for welding to iron for edge tools and for spades and shovels, although cast steel is now fast superseding its use even for these purposes. Spring steel is made by simply reducing with rolls the blistered bars, and shear steel is made by repeatedly drawing down and welding the blistered bars. This last-mentioned description is also being fast superseded since the introduction of mill welding cast steel.

The most important of what may be termed the secondary processes of this manufacture is that for producing cast steel, and it is (among the old methods of making steel) of the most recent introduction. Cast steel is different from all the other descriptions of steel in its fineness of grain, greater strength, and its homogeneity. The first steel used in this country partaking at all of the nature of this description of steel was the Indian Wootz, which was much prized by users of steel, especially by the makers of dies for coining presses, who, it is said, paid the almost fabulous price of five guineas per pound for it. The discovery of the English method of making cast steel is due to Benjamin Huntsman, of Attercliffe, who appears to have arrived at it by a series of experiments. He was a clockmaker, and desired to improve the quality of steel for clock-springs. He was born in some part of Lincolnshire in the year 1704; and, although his family are said to have been German, he must have become thoroughly Anglicised, as he was a strict Quaker. In all probability, this discovery was made before the year 1760, as it had become public previous to his death, which took place in 1776, at 72 years of age. This process was first introduced into this locality, by the late firm of Messrs. Crowley, Millington, and Co., the beginning of the present century, probably about the year 1810, who were next followed by Messrs. Spencer, of Newburn. Afterwards, Messrs. Cookson and Co. erected cast-steel melting furnaces, at their works at Derwentcote; and within the last few years, Messrs. Fulthorpe and Co., of Dunston, commenced this branch of the steel trade. Cast steel is produced by breaking the blistered steel into small pieces, and placing the same in crucibles or melting pots, capable of containing 36 to 40 lb. weight each, two of which are placed in each melting furnace. A plentiful supply of coke is now filled into the furnaces, and by the aid of a strong draught of air, an intense white heat is obtained and kept up for three or four hours, according to the nature of the steel required. When it is ascertained that the steel is perfectly melted, the crucibles are taken out and their contents poured into iron moulds conveniently placed near, and left to stand until in a cool enough state to be taken out as cast-steel ingots. These ingots are afterwards reheated and hammered or rolled, or it may be both hammered and rolled, according to the description of article for which it is intended to be used. To produce large ingots, a number of crucibles containing liquid steel are brought out of the furnaces, quickly following each other, and a continuous stream is kept flowing into the mould. There is scarcely a limit to the size of ingot that may be made in this way, as was evidenced by the monster block of steel exhibited by Krupp, of Essen, at the International Exhibition, in London, last year; but great risks are run of getting an unsound ingot, as the least delay in getting out every crucible of steel in perfect order might cause a cessation of the stream, and thus make an unsound casting. In the year 1839, a great improvement was made in cast steel by Josiah Heath, by the introduction of manganese. Having described the various processes that the several different kinds of steel undergo in its manufacture, it may be useful to notice some of the new methods that have been tried in the neighbourhood.

The method of making steel by the cementing or converting process, as already described, may be called the indirect method, because the object of the process is to deprive, in the first instance, the pig iron of the whole of its carbon, making the product as nearly as possible a pure malleable iron, and afterwards imparting to it again the necessary quantity of carbon to make it into steel. The new methods seem to aim, for the most part, at making steel by a direct process, without depriving the pig iron of the whole of its carbon, and without reducing it into a malleable iron condition. This is effected by extracting a large portion of carbon, but taking care to leave in a sufficient quantity to make steel, the object being to save the great waste of metal attending the puddling of iron, as well as the actual cost of that process. Of these last methods the Uchatius process is one that was extensively experimented on a few years ago at the Newburn Steel Works, and the following is a short description of the manner in which the process was carried on. Pig iron, of a first-class quality, was melted in a reverberatory furnace, and run into a tank filled with cold water, where it was reduced into granules; this granulated cast iron was mixed with pulverised oxide of iron and some alkaline earths, and the whole put into the ordinary steel melting crucibles, and then placed in the furnaces, to which heat was applied in the usual way until it was brought into a fluid state. By this method it was thought that the degrees of hardness of the steel was capable of being regulated by the size of the granules, and by the quantity of oxides used; but after a great number of experiments, at a cost of little under a thousand pounds, on attempting to work it in large quantities, it was found that the product was so uncertain in the qualities necessary to good steel, that the process was altogether abandoned. This irregularity of the produce was probably caused by the uncertain quantity of carbon in the pig iron used.

A method of making "puddled" steel has been tried in this locality, but without success. This process was a patented invention of Riepe, a German, and consists in puddling cast iron in a furnace constructed specially for the purpose, until it is observed to be in the condition of steel. This state is found to exist when a particular form of bubble appears on the surface of the metal.

The Bessemer process of making steel has also been introduced into the district at Tudhoe, near Ferryhill, but with what success the writer is not able to say. The operation, as is generally known, consists of blowing atmospheric air through a mass of melted cast iron until the carbon and the whole of the impurities of the iron are burnt out of it. This process has been so ably described by Mr. Bessemer himself, at the meeting of the British Association, at Cheltenham, that it is unnecessary to give a detailed description of it here; but it may be mentioned, that he commenced by extracting only a portion of the carbon, intending to leave in a sufficient quantity to produce steel, but the difficulty of adjusting the exact amount finally led him to extract the whole, and afterwards restore the exact quantity requisite by adding a measured amount of highly carbonized cast iron. Experiments in making cast steel from the Taranaki sand from New Zealand, and also from another similar sand from the coast of Italy, have been tried at Newburn with a result of getting an excellent quantity of steel; but, although yielding about 51 per cent. of metal, the cost of its production, without including anything for the sand, was so great that it would not answer commercially. It may be mentioned that this description of metallic sand appears to possess the remarkable property of not becoming oxidized when kept in a moist condition; and the writer would call the special attention of chemists and metallurgists to the fact, with the view of arriving at (what would be an invaluable discovery) the production of iron or steel that would not be subject to the destroying action of the oxygen of the atmosphere.

The articles manufactured from steel in this locality are very numerous, amongst which may be mentioned railway axles, tyres and springs, piston rods, motion bars and files for engineers' use, rings for Blakeley guns, shot, &c., the great bulk of tonnage being railway springs of various kinds; buffing, bearing, and traction in the laminated form,

as well as the volute spring originally made in this country at Newburn, and of which there have been many hundreds of thousands made the last few years. The rings supplied for guns made in this district have been pronounced by the consumers superior to any others. A firm, in this locality, has been appointed makers of springs for Mr. W. Bridges Adams' patent for the application of circular springs between the tyre and the frame wheel for all kinds of rolling stock on railways; and it is stated that springs applied in this manner effect an increased durability in Staffordshire tyres of 50 per cent. over Krupp's cast-steel tyres without the springs.

The estimated annual value of the steel manufactures of the district is about £100,000, giving employment, at the present time, to about 300 persons, and consuming annually about 15,000 tons of coals. There are in the district nine converting furnaces and 52 cast steel melting furnaces, of which the following is a list of firms having those furnaces:—Messrs. John Spencer and Sons, Newburn, 6 converting and 36 melting furnaces; Messrs. Cookson and Co., Derwentcote, 1 converting and 6 melting furnaces; Messrs. Fawcus and Co., Swalwall, 2 converting and 6 melting furnaces; Messrs. Fulthorpe and Co., Dunston, no converting and 6 melting furnaces.

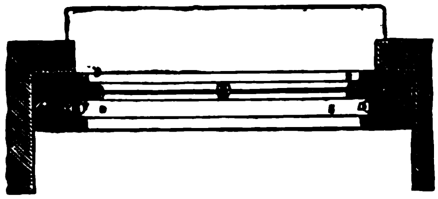
As far as can be ascertained, it would appear that the number of persons employed in this trade in 1838, would be from 70 to 80, and the weight of steel produced annually at that time would be about one-ninth the quantity now produced. The prices of steel range from about £18 to £112 per ton, according to the description, the quality, and the size. This district is highly favourable for the development of the manufacture of steel of the best quality, owing to the facility and cheapness with which a supply of iron can be obtained from Sweden—freights frequently being as low as 3s. 6d. per ton—and also owing to an abundant supply of cheap fuel and labour in the neighbourhood. The business requires, however, the most vigilant attention of thoroughly practical and experienced persons in its management to attain any considerable amount of success.

MEEARS' IMPROVEMENTS IN FITTING SASH FRAMES AND SASHES.

This invention has for its object the arrangement and fitting of sashes in such manner that they shall work without noise, and shall be so packed as to be practically air-tight and water-tight, to exclude dust, and be prevented from vibrating or shaking. For this purpose, instead of suspending and working the sash as at present by lines, weights, and pulleys, the patentee fits it with tubes of elastic material charged with atmospheric air or with gas. These tubes are attached to the sash, one on each side thereof, in a groove or recess therein, and (when working with the sash) they slide up and down in corresponding grooves or recesses in the jambs, or fixed sash frame or window frame, and thus retain the sash at any required height in the frame. Each such groove or recess may be semicircular or semi-elliptical in horizontal section, and when the sash is in the frame each recess in the sash has opposite it a corresponding recess in the fixed sash frame or jamb; such two opposite recesses, when together, form a cylindrical or elliptical space, in which is the tube fitting closely, one-half in the sash groove, and the other half in the frame or jamb groove. The tubes are made of caoutchouc or gutta percha, or of caoutchouc or gutta-percha compounds, or of other flexible and elastic material, and are hermetically closed or secured at both ends. They are charged by pumping or otherwise with air or gas under such pressure as may be required to sustain the weight of the sash by means of any suitable apparatus for injecting the air or gas and closing the same when filled, as is well understood.

The accompanying drawing is a horizontal section of a sash and frame arranged according to this invention.

A, A, are the jambs or styles of the fixed sash frame or window frame; *a*, *a*, semi-cylindrical or semi-elliptical grooves therein; B are the sash styles, and *b* are grooves therein corresponding to the grooves *a*; D are tubes of elastic material charged with air or gas, and closed at both ends. These tubes are cemented into the grooves *b*, and when they slide up and down with the sash they work in the grooves *a*.



In carrying out this invention where a new frame is to be constructed, then, instead of the present frame or style (formed hollow to receive lines, weights, and pulleys, and with a parting bead), the patentee fixes solid jambs, one on each side of the sash frame, and forms in each jamb a groove, as above described, for the tube to work in; but he applies the invention to window frames already constructed by removing the portion next the sash, and replacing it by a suitable solid grooved jamb; or the jamb may be attached to the ordinary frame. The window frame may be so constructed that the sash may be bodily removed from it (when needful, as for convenience of cleaning, &c.) by forming the lower half of one jamb in two parallel portions—the portion A^1 next the wall being a fixture, and the portion A^2, in which is the groove *a*, being screwed or otherwise attached to the part A^1, so that it may be removed from it when required to allow of the sash being withdrawn from the frame. And if it be desirable to add means of ventilation, the bottom rail of the lower sash, or the top rail of the upper sash, or both these rails may be made hollow, and perforated on both sides; the perforations on one side being respectively opposite those of the other side, and in the hollow of the rail is closely fitted a tube perforated on both sides, and capable of being slidden to and fro longitudinally within the rail by a handle projecting through a slot. When the tube or box is so slidden as to bring its perforations opposite those in the sash rail, currents of air will pass through; these currents being intercepted when the parts of the tube or box without perforations are brought opposite the perforations in the rail. The holes may be disposed in plain rows or in ornamental figures. Also ventilation may be afforded by other arrangements in the upper and lower rails or in the glass.

The invention is applicable to house, carriage, and other sliding sashes, whether fixed vertically or otherwise; and also to the covers or sliding parts of cases or other receptacles from which it is desirable to exclude air and dust.

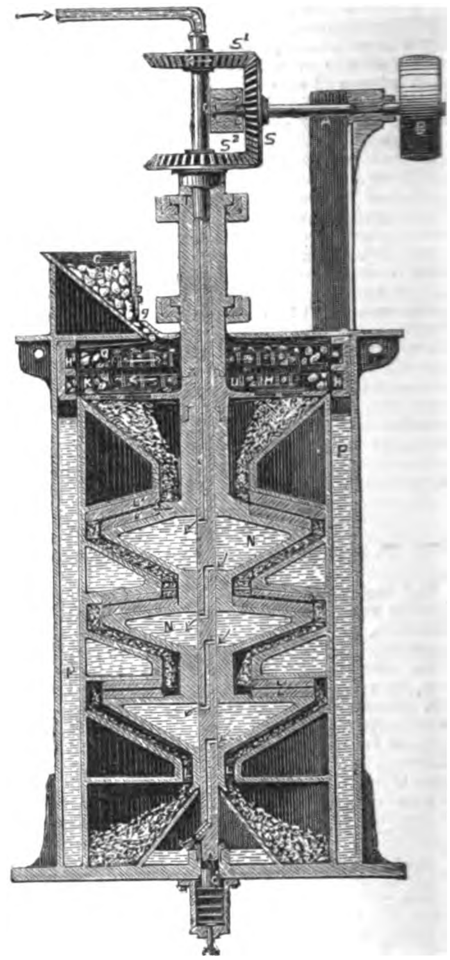
MOSHEIMER'S QUARTZ-CRUSHING MACHINERY.

The following improvement in machinery for crushing and grinding quartz, &c., has been patented by Joseph Mosheimer, of Dolgelly, Merioneth, Wales:—

The nature of this invention consists in combining in the same machine the two principles of crushing and grinding quartz and other substances.

First, the quartz or other substance is crushed by centrifugal force, and then it is ground fine by suitable grinding machinery.

In reference to the first operation, the patentee observes, that if a piece of rock or ore is let fall on to a hard surface from a given height, it will, in proportion to the height from which it has fallen, be more or less broken to pieces. Now, if force be employed to throw a piece of quartz at, for instance, the velocity of 600-ft per minute against a solid piece of iron, such a tremendous blow is given to the quartz that it will be thrown back and shattered to pieces, and in course of time, if the blows are repeated, the quartz will be reduced to as fine a state as may be required; but in order that every particle which escapes reduction by this operation may be reduced to powder, the inventor places under the crushing machine a grinder, which acts on the plan of a grinding-mill. This grinder is constructed entirely of iron, and is kept cool by a continual stream of water which is made to pass through its centre, as shewn in the accompanying drawing, which represents a vertical section



taken through the centre of the machine. It will be seen that the water enters the machine by the hollow shaft C, as indicated by the arrow, and fills all the empty spaces at N, N, inside the grinding surfaces, and it is finally discharged at O, as shown by the arrows. The outside of the whole machine is also kept cool by water surrounding the grinder in the hollow jacket P, P. The machine is set in motion in the following manner:—

A is the driving shaft, on which is fixed the pulley B, which is driven by steam or other power; to the shaft A is fixed the bevel wheel S, gearing above in the wheel S^1 fixed to the shaft C, and below in the wheel S^2 fixed to the hollow shaft T. The lower wings K, K, of the crusher, and the grinders L, L, L, are fixed to the shaft C, and revolve in one direction, while the hollow shaft T is turned in the opposite direction; to the lower end of the shaft T is fixed the rotating wheel or wings Q, Q, of the crusher. By this arrangement a double action of the wings K, K, and Q, Q, is produced; for as the wings Q, Q, are placed above the wings K, K, and they run in opposite directions, if a piece of quartz be thrown by the lower wing it will be caught by the upper one and rebounded to the lower wing, or on to the flat revolving plate U, on which the wings are fastened, and so on continually until the quartz is reduced fine enough, it is then discharged through the sieves R.

The quartz to be crushed is introduced through the hopper G, and passes through the opening *g*, from whence it falls to the revolving bottom plate U, and by the centrifugal motion of this plate all the particles are instantly carried to the outer part of the wings K, and then thrown against the fixed grooved sides H, or against the

upper wings Q, Q, by which they are re-thrown in the opposite direction. On the revolving bottom plate U are placed several punched sheet-iron screens or sieves, through which the fine reduced quartz falls, and is conducted to the revolving grinders L, by passing between which and the stationary grinding surfaces L', it will be ground as fine as may be required, and will then be discharged at the bottom through the openings I. At the bottom of the grinder shaft is a set screw C', furnished with india-rubber plates, by which the grinders may be so set as to grind close and fine, and yet to have some elasticity.

IRON-CLADS ON THE MERSEY.

For a considerable time past, says the *Times*, mysterious assertions have been circulated respecting two iron-clads building in Mr. Laird's yard, and the Federal spies have never lost sight of them. Messrs. Laird, however, make no mystery about "El Tousson" and "El Mounassir," as the ships are named. They are, undoubtedly, built on French account, and it is understood that the French Vice-Consul has given the Collector of Customs satisfactory explanations respecting them. "El Tousson," which was launched some time ago, will be ready for a trial trip in a month or six weeks. "El Mounassir" was only launched on Saturday, but already a portion of her machinery is on board. Perhaps there are not two more formidable frigates afloat. They are 230 ft. over all, 42 ft. beam, with 19 ft. 6 in. depth of hold. Tonnage, 1,850 o.m.; horse-power 350. They will combine speed with good sea-going qualities. They are very flat-bottomed, with exceedingly fine ends, and will sit low in the water. Their draught when loaded will be about 15 ft.; estimated speed, 11 knots. The stem is so formed that the vessel may be used as a ram, and the stern which overhangs affords protection to the screw and rudder from shot or collisions. The rig is that of a bark, the masts, which are telescopic, and the lower yards, being of iron. The armour-plating on the sides of the vessel is 4½ in. thick amidships, and rather less at the ends. The plates, the joining of which together is imperceptible, are fitted into a teak backing of great strength. The deck is of 5 in. teak, protected with iron. The bulwarks let down in case of action in order to allow the turret guns to fire over them. They have two cylindrical turrets on Captain Coles' principle—one before and the other abaft the engine-room, heavily plated. These turrets are made for two guns each. The pilot-house is formed of teak and iron. At either end of the vessel are raised decks, which afford excellent accommodation for the officers and crew. In the captain's cabin provision is made for two heavy stern guns, and heavy guns can be trained from the forecastle deck. These vessels have capacity for 300 tons of coal. All the machinery is below the water-line. Several experienced naval officers who have inspected the vessels, have expressed opinions most gratifying to their designers.

In the adjoining dock is Her Majesty's steam-frigate "Agincourt," of 6,720 tons. The vessel is being constructed in a dock which was adapted specially for the purpose, and is now one of the finest in the kingdom. It is about 400 ft. long, with an entrance 75 ft. wide, and a depth of water on the blocks of 24 ft. at average spring tide, or 26 ft. at a high spring tide. Rapid progress has been made during the summer months—about three-fourths of the ironwork of the hull is now fitted in place, and a large proportion of this completely rivetted and finished off, so that the carpenters have commenced with the woodwork; some six or seven streaks of the teak backing for the armour-plating are fixed on amidships, and various checks, waterways, planking, &c., are being prepared for the different decks. The forgings for the stem and stern frames have, as usual in these very large ships, required a longer time to make than was expected; but the lower part of the stem has now been in its place for some months, and the stern-post, weighing some 35 tons, was finally erected last month. The remaining parts of the stern and the rudder-post will be complete in a few weeks, and then the extreme bow and stern of the vessel will be rapidly closed in. Large quantities of the 5½-in. armour-plates have been received; and as all the machinery for preparing and fitting them has been complete and at work for some time, it is expected that rapid progress will be made with fixing them to the sides of the frigate. The winter weather will not have the effect of interfering with the progress of the work to the extent usually to be feared in this climate, as the whole ship and dock is covered with a shed, under which are placed the travelling cranes and other appliances for carrying on the work.

ON PRINTING TELEGRAPHS.

By Professor D. E. Hughes.*

The Hughes system depends for its correct action on the subdivision of time between each signal or letter, and the contact for each wave of electricity of the same duration. All other systems depend either upon the number and duration of different signals to produce the letter intended, or upon a certain number of signals indicating a certain letter. In order to obtain the results, we must secure, 1st, the perfect synchronism, or time-keeping, of two or more instruments; 2nd, the sending of the currents should be perfect as regards intervals of time and duration of contact; 3rd, the arrival of the current should be perfectly recorded, both as regards the intervals of time and the signals obtained. The instrument is driven by a weight acting upon a train of wheels, and its speed is governed by a vibrating rod. The type-wheel revolves continuously, and carries, by means of bevel wheels, a contact-making arm, which travels around a disc of pins acted upon by the finger-keys. Whenever any one of these keys is pressed down, the corresponding pin comes in contact with the revolving arm at the time wished for. The current is thus sent on the line, passing through the electric magnet, detaching the armature, which, in its rapid upward motion, comes in contact with a detent, which looks at will a small shaft to the train in motion. A cam on this shaft raises the paper against the type-wheel, causing the impression of the letter intended on the paper. At the receiving station the current acts in the same way as in transmission, detaching the armature, thus permitting the printing shaft to make one revolution, and to take the impression of the intended letter once for each current received. The transmitting and receiving instruments are brought into unison by a detent on each, which, on being pressed, stops both type-wheels at a given point, and on being released by the electrical wave, starts them both at the same instant of time. After a detailed description of the mechanical arrangements of the instrument, the methods of obtaining the results, &c., the Paper supplied the following particulars as to the special merits of this invention over others:—It will be seen, from a careful study of this instrument, that it possesses special merits not only for land lines, but for long submarine lines, from the fact of its requiring but one wave to each letter, and the sensitiveness and simplicity of the electrical arrangements. Theoretically its speed is three times greater than the Morse; and this has been fully borne out in the numerous practical trials the instrument has had. The following rates of speed were obtained in different lengths of cables:—

Atlantic cable		...	2,500 miles		4 words	per minute.
Red Sea	,,	...	2,000	,,	6	,,
,,	,,	...	1,000	,,	10	,,
,,	,,	...	500	,,	24	,,
Denmark	,,	...	300	,,	22	,,
Tasmania	,,	...	240	,,	30	,,

On aerial lines the average speed of good operators is 40 words per minute. Having stated the special merits of this instrument with regard to the velocity of transmission through submarine cables, and given various tables and particulars as to the force and time of currents, the Paper proceeded:—The electric magnet of this instrument has been also used as a measure of the force of different electrical forces. The adjusting screw on armature when graduated shows the amount of the electric magnetic force that has detached the armature. The same arrangement has been used as a measure of force under different speeds of transmission. The results of experiments in relation to these points were given. The patents for this instrument have been purchased by the Governments of France and Italy after a series of practical trials of one year's duration, and it is now in daily use on their most important lines. In the United States it has been purchased by the American Telegraph Company, and has been in operation there since 1855. The United Kingdom Telegraph Company possess the sole right for Great Britain, and it is in daily operation upon their lines between Liverpool, Manchester, and London.

* Read before the British Association, August, 1863.

A GREAT LAKE TUNNEL AT CHICAGO.

The Board of Public Works of Chicago, after considering the numerous plans suggested for obtaining a supply of pure water for the use of the city, are more fovourably impressed with that of a "Lake Tunnel" than either of the other plans, and they have already organised a corps of men to investigate the character of the bottom of the lake, to ascertain if the project is practicable. It is known from artesian borings on the lake shore, at Lill's brewery, that, about 20 ft. below the surface, a clay formation commences, which continues upwards of 100 ft. further. Wherever the investigation has been made, the bottom of the lake, where the water is more than 20 ft. deep, is clay. Should this clay prove to be continuous, and free from either beds of sand or gravel, a tunnel can easily be constructed, of sufficient capacity to supply the city for several years, and still others to increase the supply, if the first proves a success. The plan proposed by the Board contemplates the sinking of octagonal cribs 80 ft. in diameter, with central spaces, say 30 ft. in diameter, leaving an average of 25 ft. thickness to the crib around the shaft. In the central space, protected by the crib from the action of the waves, it is proposed to sink iron cylinders 9 ft. in diameter, by the pneumatic process. The outmost shaft would be constructed with reference to its becoming the inlet for the water. The others might be removed to such a depth as not to interfere with navigation.

It is proposed to construct the cribs in still water, plank their bottoms and sides water-tight for several feet up, fill them with as much stone as they can safely carry, tow them to their places, and sink them by letting water into their bottoms, and then to fill them up as promptly as possibly to their tops, with stone previously provided. Cribs of this shape and size would be stronger, and better calculated to resist the action of storms, than cribs of the same width and construction placed in a straight line. The shafts are to be air-tight iron cylinders, jointed together in sections of 6 ft. to 10 ft., and 9 ft. in diameter. They are to be sunk by the pneumatic process, which consists in exhausting the air from them to sink them, and in compressing the air sufficiently within them afterwards to force the water entirely out of them through syphons, thus allowing excavation and other kinds of work to be performed in them.

The estimated cost of excavation and masonry for the tunnel is 143,000 dols., or 13.54 dols. per lineal foot; and for the tunnel complete, 307,552 dols.

Two large scows, with all necessary apparatus on board are towed to their proper locality, and there secured by four anchors. In the space between the boats, a two-inch gas pipe is lowered and rests upon the surface of the earth, the top being 2 ft. or 3 ft. above the surface of the water. The auger is then passed down through the pipe, and worked by two men, the pipe being held in place by others. Both the outside pipe and the auger are lengthened, as circumstances may require, by the additions of joints or sections, which are readily screwed on. The pipe and auger are drawn out and lowered, by means of a derrick about 25 ft. high, with rope and tackle. Up to the present time three localities have been examined—the first three-fourths of a mile from shore. Here the water was 23 ft. deep, with a covering of four inches of sand. They penetrated 30 ft. deep, and found nothing but blue clay. The second locality was 1½ miles out. Here the water was 31 ft. deep, with about the same depth of sand. The auger was sunk 30 ft. with the same result. The third, and the last locality, was about 2½ miles due east from the water-works. Here the water is 36 ft. deep, clear and cool. The earth was here penetrated 30 ft. below its surface. The surface is covered a foot in depth with a mixture of sand, and soft mashy clay. After penetrating 6 or 8 ft., the clay becomes thick, and is harder the deeper it is penetrated. It is of a bluish slate colour, of very fine grain, with little or no grit, and would probably made excellent brick. It is apparently fine enough for pottery ware. The clay is of about the same character the entire depth, wherever the borings have been made.

At several points along the western shore of the lake there is an outcrop of limestone. A ledge of this is seen at Lake View, and another at Cleaverville, about equidistant from the mouth of the river. In order to be satisfied that none of these ledges exist in the line of the proposed tunnel, borings will be made the entire length, about 100 ft. apart. The investigations will be made about half a mile nearer the shore than those last made. This important pioneer work has been entrusted to competent and faithful men; and the Board of Public Works have reason to be very well satisfied with the result of the investigations thus far.

NEVIN AND COPPIN'S IMPROVEMENTS IN FLAX AND HEMP MACHINERY.

FIG. 1.

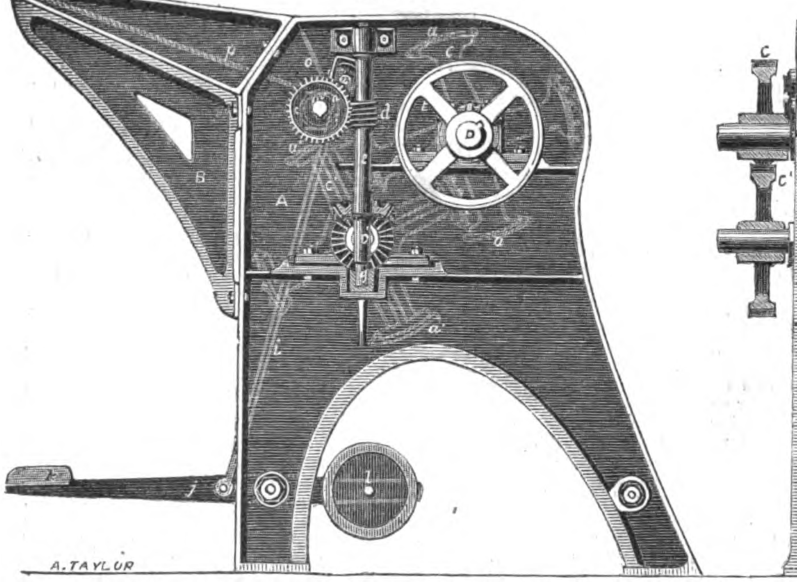
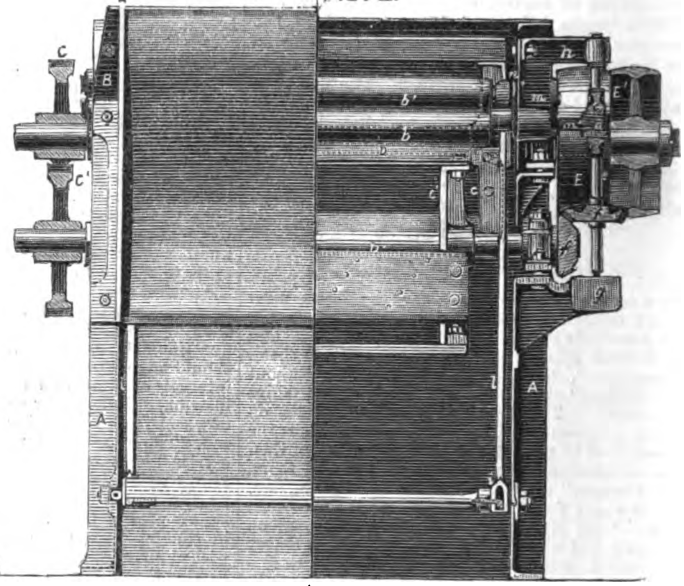


FIG. 2.



NEVIN AND COPPIN'S IMPROVEMENTS IN FLAX AND HEMP MACHINERY.

Messrs. David Nevin, and William Coppin, of Londonderry, Ireland, have patented the following improvements in machinery for clearing and separating the woody parts from the fibrous portion of flax, hemp, or other like material. For this purpose two sets of revolving flat or curved bars are used, bolted or otherwise secured to arms keyed on to two separate parallel shafts revolving towards each other. The bars of one shaft enter between the arms of the other shaft. The bars of one set pass between the bars of the other set, and are kept from contact by means of toothed wheels of equal diameters, and equal number of teeth, keyed on the two shafts working into each other. One or more of the bars in each set are provided with short teeth for the purpose of keeping the fibre straight and clear. Above the revolving sets of bars is placed a cover, having a rectangular opening through which to pass the fibrous material, and by the action of the bars both sides of the flax or other like material are cleared at the same time. An improved set of holders or clips for holding flax, hemp, or other like material while being dressed or cleaned is provided. Each holder or clip consists of two sets of bars or fluting faced or covered with india rubber or other like material, having a joint or hinge at one end; the two sides closing fit into each other, and are held together by the aid of springs and rackwork; one of these holders being placed or fastened on the end of the material to be dressed, the other end is passed through the opening in the cover of the machine and dressed between the revolving sets of bars, and when sufficiently acted on is withdrawn, and the dressed end is secured in another clip or holder, the first then being removed, and the undressed end passed through the opening and dressed in like manner.

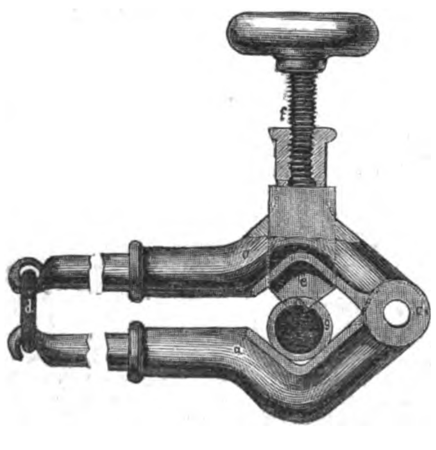
Fig. 1 is an end elevation, fig. 2 a front view (part in elevation and part in section) of a machine constructed according to this invention.

A, fig. 1, is a side frame enclosing the revolving beaters and feed rollers; B, frame for supporting the feed boards; C, C[1], centres or arms on which the beaters are secured; D, D[1], shafts for carrying the centres; E, E, a fast and loose pulley on shaft D; G, G[1], spur wheels on the shafts D, D[1]. *a*, *a*, *a*[1], *a*[1], beaters with teeth for keeping the fibre straight; *b*, *b*[1], rollers for feeding, either plain or fluted; these rollers the patentees prefer to employ, especially when the feed board, on which the fibre to be acted on is spread, is only slightly inclined, but when the feed board is set at a considerable inclination, the rollers may be dispensed with; *c*, worm wheel mounted on end of lower roller spindle; *d*, worm or screws for communicating motion to roller; *e*, upright shaft; *f*, *f*[1], wheel gearing mounted on upright and beater shafts; *g*, footstep; *h*, bracket for securing top of upright shaft; *i*, rod for connecting top feed roller with lever *j*; *k*, footboard for depressing lever and tightening roller on material when in operation; *l*, counterbalance for raising roller; *m*, *m*[1], feed roller spindles; *n*, *n*, bushes in framing (the upper one made to rise high enough to admit the material); *o*, guide plate for conducting material between rollers; P, food board on which the material is evenly spread for feeding the machine.

BARRACLOUGH'S APPARATUS FOR CUTTING METALLIC TUBES OR PIPES.

Letters Patent have just been granted to Thomas Critchley Barraclough, engineer, Manchester, for improvements in appliances for cutting pipes or tubes of iron or other metal.

The apparatus consists of two metallic jaws, by preference made of malleable or other elastic description of cast iron or steel, and hinged together at one extremity and so formed near the hinge or joint as to receive the pipe to be cut at right angles to the cutters employed; to these jaws, at the farther end to the hinge, two steel



or wrought-iron rods are attached. The cutter, which is made of steel, slides vertically through one of the jaws, and its cutting force or pressure may be adjusted by means of a thumb-screw above it. The pipe to be cut is placed in the hollow made for its reception, the two opposite ends of the rods are then brought nearly together and secured by a link, links, or other substitute, the jaws being thus caused to hold the pipe, and the cutter is tightened thereupon. If now the pipe be held firmly in a vice, and the apparatus turned several times round in a direction at right angles to the axis of the pipe, the cutter will penetrate the material and dissever the tube. If the metal or substance of which the tube is made be very thick, more pressure is to be applied gradually to the cutter by means of the screw until it is cut through.

The accompaning figure represents a side view (shown partly in section) of the apparatus for cutting tubes, shown in the operation of severing a tube, and in which *a*, *a*, are the jaws made of malleable cast iron or other metal, which are hinged together at *c*, and to which are attached the rods *b*, *b*, made of steel or other slightly flexible metal, and are retained in the position shown by means of the link *d*, or other convenient means of attachment. The cutter *e* is made of steel, and slides in a slot in the upper jaw, and may be tightened to any required pressure by means of the screw *f*, so as to cause the cutting points to enter the tube *g*, which is held in a vice or otherwise fixed whilst the apparatus is turned round, causing the cutter to enter and by continued turning to sever one portion of the tube from the other.

MORELAND AND CHAPPELL'S IMPROVEMENTS IN WINDING, WARPING, OR DRESSING MACHINES.

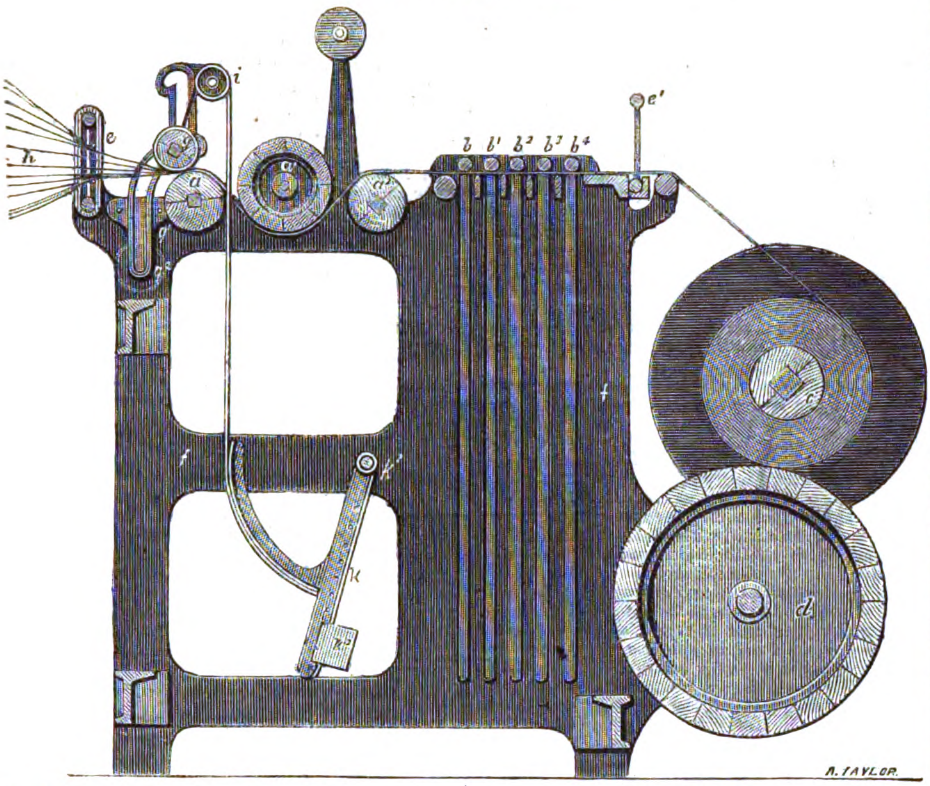
The following improvements in warping and dressing machinery have been recently patented by William Harrison Moreland and John Chappell, both of Loop Bridge Mill, near Belfast:—

The invention consists in the application to the ordinary winding, warping, beaming, or dressing machines that wind from the spools or bobbins, of a drag roller or rollers, for taking up the slack yarn caused by the over-running of the spools or bobbins from which the yarn is being wound.

The method of this application will be understood from the following description and drawing which is a section of a warping machine as used for linen yarns, with this improvement applied to it.

a, *a*[1], *a*[2], are the ordinary rollers of the machine, over and under which the yarn passes, *a*[1] being the measuring roller; *b*, *b*[1], *b*[2], *b*[3], *b*[4], are

MORELAND AND CHAPPELL'S IMPROVEMENTS IN WINDING, WARPING, OR DRESSING MACHINES.



the falling rods for taking up the slack yarn when backing off to find an end, &c.; c is the beam whereon the yarn is wound; d, the roller that drives it by surface contact; e, e^1, are the reeds or guides for the yarn; f, the framing of the machine. The drag roller g rests upon the yarn, where it passes on to the roller a, the direction of the yarn as it comes from a creel or bank which carries the spools or bobbins being shown by the lines h. The roller g has a pivot at each end, which pivots pass severally through an eye fastened to a strap or other suitable material led over the carrier pulley i, and connected to a weighted balance lever k, supported by a stud k^1 fixed to the framing f. The pivots on the ends of the rollers g, after passing through the eyes of the straps, enter guides g^1, which are fastened one at each side of the framing f. The slot of these guides is continued below the centre of the roller a, to allow the roller g to fall as the yarn is slackened.

The action of this roller g is as follows:—When the machine is stopped, the spools or bobbins are liable to over-run, and thus leave the yarn slack until the winding recommences, but the roller g, resting wholly or partially on the yarn, falls down the slot or guide as soon as the yarn begins to slacken by the stoppage or slackening of the winding, until it attains the dotted position g^2. To prevent the weight of this roller from continuing to take up the yarn at the first speed, it is caused to raise the lever k from its vertical position, as shown, to a position approaching a horizontal one, thus gradually increasing the power of the weight k^2 until it, with the slight tension on the yarn, balances the roller g. By this means a uniform tension is secured to the yarn throughout the beam, and the action of the measuring roller a^1 is rendered certain.

The slack roller or rollers may be placed either before or behind the reed or first guide e_1 through which the yarn passes, and be supported either together or in part only by the yarn.

This improvement is applicable to all beaming, warping, or dressing machines that wind from the spool, whether for flax, cotton, or other yarns.

GUN-COTTON.

DR. GLADSTONE read the chemical portion of the report of the Committee on Gun-Cotton before the British Association. The report stated that during the year the committee had been put in possession of the fullest information on the subject, by Baron William Von Lenk, Major-General of the Austrian Artillery, who was the inventor of the system by which gun-cotton was made available for warlike purposes; and Professor Abel, chemist of the War Department, by permission of the Secretary of State for War, had communicated to them the information given by the Austrian Government to the Government of this country. The committee had made no experiments themselves. The subject might naturally be divided into two conditions—the chemical and mechanical. Taking the chemical first, that department included the manufacture of gun-cotton itself, its liability or non-liability to spontaneous combustion, and the nature and effects of the products into which it was resolved on explosion. As to the chemical nature of the material itself, the gun-cotton differed from the gun-cotton generally made, in its complete conversion into a uniform chemical compact. General Lenk secured the production of his gun-cotton by several precautions. Of these the most important were, the cleansing and perfect desiccation of the cotton as a preliminary to its immersion in the acid; the employment of the strongest acids obtainable in commerce; the steeping of the cotton in a fresh strong mixture of acids, after its first immersion and consequent imperfect conversion into gun-cotton; the continuance of this steeping for 48 hours. Equally necessary is the thorough purification of the gun-cotton so produced from every trace of free acid. There is one part of the process of the manufacture, the value of which is not open to doubt—viz., the treatment of the gun-cotton with a solution of silicate of potash, commonly called water-glass. The chief advantages of the material were set forth in the mechanical report; but it was here stated that the fact that gun-cotton is not injured by damp like gunpowder, is one of its recommendations; while a still greater chemical advantage which it possesses arises from its being perfectly resolved into gases on explosion, so that there is no smoke to obscure the sight of the soldier who is firing, or to point out his position to the enemy, and no residue left in the gun to be got rid of before another charge can be introduced.

Mr. Scott Russell, F.R.S., submitted the mechanical report. After a long and careful examination, the committee were able to understand and reconcile themselves to the fact that greater mechanical effects are produced from gases generated by gun-cotton than by those generated by gunpowder. The same quantity of gases and the same number of atmospheres seemed to be produced from both materials, and it did not appear to mechanical men that there was a greater advantage in gun-cotton in that respect. The next inquiry was into the distinctive nature between the action of these gases in gunpowder and the action of those gases in gun-cotton. The great waste of force in gunpowder constituted an important difference between it and the gun-cotton, in which there was no waste. Gunpowder consisted of about 68 per cent. of solid matter, only 32 per cent. of which was useful gases. It might be seen, therefore, that one-third of gunpowder is not directly useful in producing gases. There was another peculiar feature of gun-cotton—it could be exploded in any quantity instantaneously. Gen. Lenk had discovered the means of giving gun-cotton any velocity of explosion that is required by merely the mechanical arrangement under which it is used. Gun-cotton in his hands had any speed of explosion, from one foot per second, to one in 1000th of a second, or to instantaneity. The spontaneous explosion of a large quantity of gun-cotton is made use of when it is required to produce destructive effect, and it is found that the condition necessary to produce instantaneous combustion is the absolute perfection of the closeness of the chamber containing the gun-cotton. On the other hand, if they desired gun-cotton to produce a different effect, they must provide for its slower combustion. It must be abstracted and opened out mechanically, so as to occupy a large space, and in this state it can be made to act even more slowly than gunpowder, and come within the limits which render it fit for the purposes of artillery. In general it is found that the proportion of 11lb. of gun-cotton occupying one cubic foot of space, produces a greater force than gunpowder, and a force of the nature required for ordinary artillery. But each gun and each kind of projectile requires a certain density of cartridge. Practically, gun-cotton is most effective in guns, when used at a quarter to one-third weight of powder, and occupying a space of one and one-tenth of the length of the powder cartridge. In regard to safety, it was a fact that during the ten years of the manufacture of General Lenk's gun-cotton at the imperial factory at Kirtenberg, and during ten years storage of that material in the imperial magazines at Steinfeldt, in which thousands of cwts. were deposited, not one single accident occurred. The best temperature for gun-cotton was 136 degrees centigrate, or between 277 degrees and 338 degrees Fahrenheit—a temperature sufficiently high to ensure safety for all practical purposes. The cost of production was considerably less than that of gunpowder, the price and quantities being compared, which will produce equal effects. As to the mechanical purposes of the cotton, it is used for artillery in the form of gun-cotton thread or spun yarn. In this simple form, it would conduct combustion slowly in the open air at the rate of not more than one second. This thread was woven into a texture or circular web. These webs were made of various diameters, and out of them cotton rifle cartridges were made by cutting them into the proper length. The cotton web was generally enclosed in india-rubber tubes, in which form it is most convenient. For the explosion of mines it is used in the form of ropes. Conveyance and storage of gun-cotton:—One pound of gun-cotton produces effects somewhat exceeding 3 lb. of gunpowder in artillery. This is a material advantage, whether it be carried by men, by horses, or in waggons. It may be placed in a store and preserved with great safety. The danger from explosion does not arise until it is confined. It may become damp, and even perfectly wet; and, without injury, may be dried by mere exposure to the air. Practical use in artillery:—The gun keeps clean, and requires less windage, and therefore performs much better in continuous firing. In gunpowder there is 68 per cent. of refuse, or the matter of fouling. In gun-cotton there is no residuum, and therefore no fouling. Experiments made by the Austrian Committee proved that 100 lb. could be fired with gun-cotton against 30 lb. of gunpowder. From the low temperature produced by gun-cotton, the gun does not heat. Experiments showed that 100 lb. were fired with a 6-pounder in 34 minutes, and the heat was raised by gun-cotton to only 122 deg. Fahr.; whilst 100 lb. of gunpowder took 100 minutes, and raised the temperature to such a degree that water was instantly evaporated. The firing with the gunpowder

was therefore discontinued, but the rapid firing with the gun-cotton was continued up to 180 lb. without any inconvenience. The absence of fouling allows the mechanism of a gun to have more exactness than where allowance is made for fouling. The absence of smoke permits rapid firing and exact time. The fact of smaller recoil from a gun charged with gun-cotton is established by direct experiments. Its value is two-thirds of the recoil from gunpowder, the projectile being equal. Practical application to destructive explosion:—It is ascertained that the same shell is exploded by the same volume of gas generated from gun-cotton and gunpowder into more than double the number of pieces; and it is a startling fact that the stronger and thicker the shell the smaller and more numerous are the fragments. Mining uses:—The fact that the action of the gun-cotton is violent and rapid in exact proportion to the resistance it encounters, tells us the secret of the far higher efficacy of gun-cotton in mining than gunpowder. The stronger the rock, the less gun-cotton comparatively with gunpowder is found necessary for the effect—so much so that while gun-cotton is stronger than gunpowder, weight for weight, as 3 to 1 in artillery, it is stronger in the proportion of 6·27 to that of strong solid rock, weight for weight. It is the hollow rope form which is used for blasting. Its power in splitting up material is executed exactly as you wish. With regard to the military and submarine explosion, it is a well-known fact that a bag of gunpowder nailed on the gates of a city will blow them open. A bag of cotton exploded in the same way produces no effect. To blow up the gate of a city with gun-cotton, it must be confined before explosion. Twenty pounds of gun-cotton carried in the hands of a single man would be sufficient, only he must know its value.—Other effects of the Austrian invention were enumerated, and the Paper throughout was of a most interesting character. The experiments, the results of which were detailed, had been conducted on a gigantic scale.

In accordance with the expressed wish of the Chairman, the conversation which ensued was limited to the chemical aspects of the question, it being intimated that the mechanical features of the subject would be discussed in that Section.

Captain Galton, presuming that there were yet many points that required further investigation, moved that a proposal be submitted to the Committee of Recommendations, that the Committee be requested to continue their labours for another year. He was sure that the War Office would be glad to assist as much in the inquiry as they had hitherto done.

Although the motion for a continuance of the inquiry was not formally put, the suggestion will doubtless be acted upon.

NEW METHOD OF WORKING RAILWAYS BY STATIONARY ENGINES.

Mr. J. F. Spencer read a Paper on this subject, before the British Association, prepared by Messrs. R. and W. Hawthorn. It was as follows:—

The Paper brought before this Section to-day is a description of a method of working a certain class of railways by means of ropes from stationary engines.

A system of working railways by fixed engines and ropes has long been in use on the colliery railways around Newcastle-upon-Tyne, as well as in other districts, and a plan for the same was made the subject of a patent by Mr. Benjamin Thompson, then of Ayton Cottage, in the county of Durham, and was introduced on one or two colliery railways. It consisted of a succession of fixed engines at certain intervals from one end of the line to the other, each engine being employed to work a portion of the railway in the following manner.

The engine gave motion to two rope rolls, and the rope from one of those rolls was attached to one end, and the rope from the other roll was attached to the other end of the train. Whilst one of the rope rolls was disengaged from the engine, and allowed to run loose, the other was in gear, and the rope from it was passed along the line, and round a loop sheave, then brought back and attached to the train. The engine being put in motion the train was dragged to the furthest end of the section worked by that engine at the same time unwinding the rope from the loose roll, and taking it with it to be afterwards employed to drag back the returning train. This was continued throughout the line, each successive engine taking up the train, and carrying it over a section of the line. This method was not a satisfactory one for the conveyance of passengers, as the rider or guard in charge had not sufficient control over the movements of the train, and there is an objection to the carriages being attached directly to the rope, and at such a distance from the motive power. Ropes have been, and are yet, applied in other ways, for instance, on gravitating or descending planes, down which a loaded train passes, having the rope attached to the after-end round a sheave at the top of the incline, and thence down to the ascending train, and thus the descending loaded train draws up the ascending light train; or, where the load has to ascend, a fixed engine is employed to draw it up, and the descending train takes the rope down with it. Ropes are also applied in a variety of ways to the working of incline planes on passenger railways. Thus, there is nothing new in the use of stationary engines and ropes for working railway trains. It will be observed that in all the cases referred to, the rope is attached directly to the carriages.

In the proposed plan now offered to the notice of members of the Association the means of communicating motion to the train give greater security as well as the advantage of avoiding the necessity of attaching a train to the end of a rope, thus ensuring to the guard as complete control over the movements of the train as he now has in the employment of the locomotive engine. In the new system it may be stated without exaggeration that the rope drives the locomotive wheels, and each carriage carries its own railway.

It is proposed with the ordinary construction and gauge of railway to place in the intermediate space between a double line of rails a series of double grooved sheaves fixed in spindles or axles which pass across under the rails extending a little over the centre of each line; a plain wheel or roller is fixed upon each end of the axles by which the motion is communicated to the train from a stationary engine or engines placed at a convenient point of the line—by the means of an endless wire or other rope passing alternately over and under the grooved sheaves to the extremity of a section of the line where it is taken round a large loop sheave and returned to the engine now passing over each sheave which it before passed under, and *vice versa*; the double groove providing for the rope crossing itself without contact.

Having traversed twice along the line of sheaves the rope goes again on to the large winding sheave of the engine, on which a sufficient number of turns are taken to ensure the requisite friction.

From this arrangement of the rope on the sheaves, it will be seen that every alternate sheave runs in the same direction, and every intermediate sheave in the contrary direction; and this motion is communicated to the traction wheels or rollers before-mentioned.

It is proposed to construct the carriages for passenger lines on the principle of those used in America, and on the Canadian railways, of a length of from 60 to 75 ft., and supported on bogies, and capable of seating from 120 to 150 passengers, each carriage to be fitted witn traction bars—these bars extending over two or more alternate traction rollers—and to be furnished with the ordinary flanged wheels for running on the rails. The traction bars, of which there are two, are placed side by side, at such a distance from each other as may be necessary to meet the requirements of the line; and these traction bars are worked either in connection with or independent of each other by a suitable arrangement of levers or other gearing, by which either of the bars can be raised or depressed, thereby bringing a portion of the weight of the carriages upon the traction wheels or rollers, thus giving motion to the train of carriages in either direction. Or both these bars can be raised out of contact with the traction wheels or rollers, and the train left free from all tractive force.

The traction bars will be nearly the full length of the carriage, and the traction rollers will be placed about 18 ft. apart, or at the rate of 293 per mile.

The carriage made in this way is adapted for running with either end first, being provided at each end with a platform, on which the driver stands to work the traction bars; and it is considered that for ordinary traffic one carriage will be sufficient to form a train, but two or more may be attached to each other, or the number of trains of a single carriage each may be increased to meet the requirements of the traffic.

The motion of the train can be quickly and certainly retarded or stopped by raising one bar and depressing the other, in the manner of a brake, thereby reversing the direction of the driving motion.

A separate or independent traction carriage may be used, fitted with the traction bars and gear; but it is considered that such an arrangement would, in most cases, only be adding a useless and unnecessary weight to the useful portion of the train.

The present line of underground railway through London, from Paddington to Farringdon-street, is favourable to the use of the locomotive engine, where so much of the surface of the ground under which it passes is unoccupied by buildings, and readily admits of a good deal of open cutting and ventilation at the stations, which cannot be the case where the railway passes under the densely-populated parts of a city, as those projected in London must do. In such cases it will be necessary to provide for working in a continuous tunnel of perhaps three or four miles in length, in which the steam and smoke of locomotive engines would prove obnoxious to a much greater extent than is experienced on the present line, which is only partially an underground railway. As there does not appear to be any means of remedying these evils, except at a very extravagant cost, it is believed that the new system may be introduced with advantage in such cases as are above referred to—viz., railways passing under large towns or in situations where opportunities do not occur of having openings to the surface.

The maintenance of the engines will be considerably less than with locomotives to balance the expense of keeping in working order the sheaves, ropes, &c., which will cost more than an ordinary line.

Both calculation and experiment on the adhesion acquired to propel a train remove any reasonable doubt of being able, by the new system, to obtain sufficient tractive force by the traction bars and rollers, and it is evidently quite feasible to increase this tractive power if required.

With a locomotive a train of 15 or 20 carriages has to be drawn by an intense pressure on six or eight points, and it is this which adds such a heavy item to the cost of railway maintenance. This disadvantage will be to a great extent remedied by the proposed system, the tractive force being more distributed, and consequently the wear and tear diminished. Finally, if such a system as the one proposed can be introduced free from the objections that have hitherto been considered inseparable from the use of ropes, it will greatly facilitate the construction and extension of underground railways without their present drawbacks.

TO CORRESPONDENTS.

Received.—J. B., R. S., H. W. P., S. B., A. A. and Co., T. B., and P.

W. N.—Mr. Obed Hussey, the inventor of one form of the reaping-machine, is dead, long since; he was, we believe, killed on the Boston and Maine Railroad, U.S.

C. F. D. (Walsal).—We cannot answer your first question. In reply to the second, we believe there is no doubt whatever that Mr. W. B. Adams is the inventor of the fish-joint.

An Engine-driver.—The head lights used on American locomotives are very large, quite powerful enough to illuminate a small lighthouse. Such lamps are extremely useful, lighting up the road very clearly for a great distance ahead. They are rather expensive, having very large and beautifully finished reflectors.

Miscellanea.

We have received the following from Messrs. Robinson and Co., Denton Mills, Carlisle:—As an illustration of what can be accomplished by modern machinery, we have pleasure in sending you the enclosed box of biscuits, made from wheat grown upon our reclaimed waste lands formerly occupied as the Carlisle Canal Reservoir, reaped "this morning" by McCormick's reaping machine, thrashed on the spot by a steam thrashing machine, conveyed to Denton Mills, manufactured into flour, and made into biscuits by patent machinery which gained the prize medal at the International Exhibition, 1862.

On Saturday two splendid additions were made to the fleet of the Peninsula and Oriental Steam Navigation Company by the launch of two powerful iron screw steamers, named the "Golconda" and "Baroda," at Blackwall. Both vessels are frigate built, and of the same dimensions—length 295 ft., 2,090 tons register, and 400-horse power.

The principle of the adaptation of double screws to ships of war has been so far acknowledged in its importance by the Admiralty that their lordships have given Messrs. Dudgeon an order to construct a small vessel which shall combine in their most efficient form the double-screw principle which they have successfully brought into public notice.

On Thursday week one of the "Royal Alfred's" armour plates, measuring 15 ft. in length, 3 ft. 6 in. in width, and 4 in. in thickness, was successfully covered with its coating of copper by the "Walenn" process, in the steam factory at Portsmouth. The thickness of the coating was the sixty-fourth part of an inch, and it was deposited with an even and bright surface, notwithstanding that a plate had been selected by the dockyard officials, which was undercut and honeycombed on its outer surface.

The cotton defences of Fort Sumter proved a failure. The guns set the cotton on fire. A part of it fell into the sea, and the rest was saved. King Cotton could not help his subjects.

A Washington correspondent gives the following account of the wheelwright and carriage department of the army at Washington:—Every kind of woodwork repair is done here, for all sorts of waggons and vehicles used in the army, including painting and trimming, and, in occasional times of leisure, new waggons are manufactured. All the broken carriages and fragments are brought here from the army of the Potomac; and so closely worked over, that few fragments are left to be conveyed out of the way. The quantity of these broken down, mashed up, and played-out machines that come into this yard daily is on a gigantic scale; and those who see these traps go in such quantities daily into this yard, and disappear for ever, very often, without knowing that they do go out daily in the shape of good waggons, express their astonishment that the whole city is not covered over with the fragments.

Sweden has abolished all export duties. Among the articles affected by this resolution are several which, it is considered, will be before long imported into England, such as cattle, bones, cast and pig iron, copper, rags, ores or metals, and many kinds of wood.

A report is current at Constantinople that the Turkish Government intends, for the future, to have the metallic currency of the Ottoman Empire coined at the Paris Mint.

We learn that Mr. Freeman, of Cannon-street, the executor of the late James Fenton, so well known as a practical engineer, and whose decease was noticed in our Journal at thetime, is doing honour to his memory by attempting to raise a memorial fund for the education and advancement of his children. We sincerely hope that he will meet with that encouragement so excellent an object deserves. We are not fond of testimonials to the living, because it seldom happens that they are presented to those who really need them, but in this case it must be a simple matter of respect to the memory of a man who while living was greatly estimated.

Some months ago, the keel for a steamer, 300 ft. long, was laid opposite Shanghae. As there is not any timber in that part of China suitable for so large a vessel, it was built of teak, Siam wood, and Oregon pine. The engines are from the Neptune Iron Works, New York, fitted up in Shanghae by Mr. James A. Smith. She is in all respects a first-class steamer for the the Yangtze river service, and is estimated to carry from 1,800 to 2,000 tons of cargo.

Messrs. Deville and Caron have lately been making experiments on the properties of a new gun, metal, a compound of silicium and copper. When copper contains rather less than five per cent. of silicium, it presents a fine bronze colour, is fusible, and rather harder than bronze,—but is perfectly ductile, and can be readily worked without clogging the tools as bronze does. Its tenacity is remarkable, being equal to that of iron. Silicium is the basis of sand, and the manufacture of its compounds with copper may be made by fusing together a mixture of sand, sodium, and copper, with some common salt and fluor spar as flux.

M. Nadar's newly-invented aerial machine, which is occupying considerable attention in Paris, is already nearly half-finished. Its dimensions are so enormous that it will have accommodation, it is declared, for more than a hundred passengers. The first aerial journey is to be made to Baden. M. Nadar will call his balloon the "Quand-Même."

We extract from a contemporary the following description of Hughes' printing telegraph, as exhibited in Newcastle at present:—The machine is fixed to a table or platform not larger than an ordinary chess-board, and is altogether very neat and compact. The electric waves are transmitted by a revolving arm, which acts in concert with a type-wheel. On the face of the instrument are 28 keys, arranged like those of a piano, but occupying less than a third of the space. These correspond with an equal number of metal plates, working upwards through slots formed all round a circular disc, on the top of which, but not in connection with it, the arm and what is called "contact-maker" revolve. The type-wheel and this arm revolve together, and when a key is depressed by the operator, a plate corresponding with the letter touched is raised, and a letter is printed, while at the same instant, by a graduated movement, the paper is carried on a space ready to receive the next impression. The instrument is worked chiefly by women, and very much after the manner of a piano, but with a heavier touch. It prints at both ends of the wire simultaneously, and in clear type, so that the operator sees the message which is being transmitted as it proceeds, and no copying or translation being required, the chance of error is avoided. The speed secured in France and America, by highly-trained operators, is said to have reached from forty to fifty words a minute. At this rate the instrument would print matter equal to a column of the *Times* in a few minutes less than an hour, assuming there was no break in the operation, which probably would be too much to assume. It was brought into use in transmitting a report of the recent speech of Mr. Bright at Birmingham.

The latest discovery in portraiture is an invention, styled by the patentee the "Casket or Crystal Cube Minature," by which a solid image of your head is, by some new development of the photographic art, seen looking with a strange living reality from out the centre of a small cube of crystal, every feature standing out in as perfect relief as though chiselled by the hands of fairy sculptors.

The Secretary of State for War has considered it expedient to establish a uniform rule in regard to the grant of public holidays to the artificers, labourers, &c., in the various branches of the War Department, and has therefore decided that in future the following days only shall be observed as holidays with pay:—Good Friday and Christmas Day, the latter, if falling on a Sunday, may be observed on the following day; the anniversary of the Coronation of the Sovereign; and the day fixed each year for the observance of the Sovereign's birthday.

The gentry and merchants of Galway have subscribed £10,000 for the construction of a graving dock to accommodate and repair the Atlantic mail fleet; but this sum is only one-third of the amount required for the work, and the *Galway Vindicator* urges the necessity of increased exertions upon the Dock Company, in order to raise £10,000 more, which would be sufficient, as the directors of the Atlantic Company have promised individually to subscribe £10,000 among themselves, without however, entering into the Graving Dock Company as a body.

The annual meeting and cattle show of the Royal Irish Agricultural Society took place last week at Kilkenny. The show of fat cattle was extremely good. In the implement department the display was very creditable to Irish engineers. Fowler's steam-plough was at work the three days of the show, and from its novelty in Ireland proved an immense attraction. Our own engineers would find in the Sister Isle a very fair field for the sale of machinery specially constructed to meet the demands of a class who cannot expend much capital. It is sufficiently remarkable that the use of the reaping machine is more general there than here. Its small price placing it within the reach of farmers who are, as a body, really anxious to avail themselves of the benefits of machinery.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 250, 251, 253, 274.
BOILERS AND FURNACES, 229, 258.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 227, 236, 259, 263, 280, 281, 282.
SHIPS AND BOATS, including their fittings, 238, 249.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 221, 260, 270, 277.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 233, 262, 275, 279.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 224, 225, 239, 245, 257, 268, 284, 288.
BUILDINGS AND BUILDING MATERIALS, 232, 235, 243, 255, 269.
LIGHTING, HEATING, AND VENTILATING, 242, 244, 247, 248, 266, 273, 287, 289.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 222, 226, 228, 230, 231, 234, 240, 246, 256, 264, 265, 276, 278, 283.
METALS, including apparatus for their manufacture, 223, 237.
CHEMISTRY AND PHOTOGRAPHY, 267, 271, 272, 285, 286.
ELECTRICAL APPARATUS, 241.
WARFARE—*none*.
LETTER-PRESS PRINTING, 251, 254.
MISCELLANEOUS, 261.

221. W. CLARK. *Improvements in syphons applied to draining, irrigation, and other purposes, whereby they self-suspend and resume action according to requirements.* (A communication.) Dated January 24, 1863.

This invention consists in the application of a float which closes the cock for passing water when there is no longer any to remove; the said cock again opens on a return of water in the place to be exhausted, and when once in position, the syphon works automatically. *Patent abandoned.*

222. A. J. SAX. *Improvements in rendering drum-skins and gut-strings less liable to hygrometric influences.* Dated January 24, 1863.

This invention consists in impregnating or coating the skins of big, little, or other drums, tambourines, or other musical instruments of the same class, as well as the gut-strings of violins, basses, violoncellos, or other musical instruments provided with such strings, with a solution of any suitable chemical agent which, after becoming dry, will render the said skins or strings sufficiently impervious to wet as to prevent them from attracting moisture with the same avidity as those bodies are liable to when left in the state they have been made use of up to this moment for the above-mentioned purposes. The liquid the patentee prefers to make use of is collodion. *Patent completed.*

223. R. A. BROOMAN. *Improvements in the manufacture of anvils and other metal articles requiring hard surfaces.* (A communication.) Dated January 24, 1863.

This invention consists—1, in manufacturing anvils by the direct superposition during the casting of two metals united so as to form one body; 2, in the substitution of casting for forging in the manufacture of anvils, thereby diminishing in a great measure both hand labour and expense. *Patent completed.*

224. F. TOLHAUSEN. *Improvements in looms for weaving ribbons.* (A communication.) Dated January 24, 1863.

In this improved loom the batten or lathe is made with twice the number of pieces, but with the same longitudinal dimensions as in the ordinary loom. The second or additional set of pieces is placed underneath the first set, thus increasing the height of the lathe; and the space between the successive warps is made available for placing the reeds through which each double piece of ribbon passes. By this arrangement the operative is enabled to see all the pieces weaving, bearing in mind, however, that in fancy weaving the upper warps are woven the right side up, whereas the lower ones are woven the wrong side up, as each of the shuttles works the upper warp in its ascending course, and the next lower one in its descending course. The batten is divided into two parts which slide on blocks, and can be set more or less apart according to the nature of the work. When one of these parts rises, the other is depressed to an equal amount. To the ordinary jacquard which acts direct on the upper ribbon warps the inventor superadds another having no card cylinder or beam, and acting direct on the lower or additional warps. This auxiliary jacquard is set in motion by means of a double lever, which oscillates between the two jacquards in such a manner that it lifts the shed on one side, whilst it lowers the shed of the other warp. For the said purpose the wires or needles in the first jacquard are made longer than usual, so as to work into the auxiliary and produce the contrary effect therein. The auxiliary jacquard carries a moveable board on its grif to support the hooks holding the threads; when the board descends, all those hooks which are not hung on the blades of the grif or leash-box descend along with it. *Patent abandoned.*

225. F. TOLHAUSEN. *Improvements in machines for carding fibrous materials.* (A communication.) Dated January 24, 1863.

This invention consists in applying doffing combs to each of the rollers that in a certain description of carding engines are set round the main carding cylinder; the object of this addition is either to obtain a greater quantity of carded material, or to produce a finer lap of superior quality. In the former case, the webs produced by the rollers and the combs are at once delivered or taken off either laterally or in any direction by delivery rollers; in the latter case, the webs doffed by the said combs are united into one lap, which is then at once passed through the carding engine again. The said combs are set in motion by any of the devices now in use for doffing combs. *Patent completed.*

226. W. F. STANLEY. *Improvements in mathematica drawing instruments.* Dated January 26, 1863.

This invention is not described apart from the drawings. *Patent completed.*

227. J. B. Fell. *Certain arrangements for working railway engines and carriages on steep inclines, to consist in enabling engines and carriages to travel up and down steep inclines with great facility and security.* Dated January 26, 1863.

For the purposes of this invention, the patentee applies to the engines and carriages, wheels in pairs or sets of two or more, so arranged as to work on either side of a central rail, and to press and hold on such rail with a pressure and holding adapted to the circumstances of each case. In travelling up inclines, the wheels of each pair or set are worked by the engine at a speed, and with a pressure, on each side of the central rail, according to the load and the rate at which the engine has to travel, and the adhesion necessary for taking the load up the incline. In descending the inclines, these pairs of wheels on the engine and carriages are employed as breaks, with an adhesion adapted to the load. These pairs of wheels also hold on either side of the central rail in such manner as to afford a great amount of security against the wheels of the engines or carriages jumping and getting off the lines of rails on which they are travelling. *Patent completed.*

228. A. Smith. *Improvements in certain parts of staples, locks, bolts, latches, and other similar fastenings.* Dated January 26, 1863.

This invention relates to the introduction of a wheel or roller in the keeper of spring locks or latches, and other similar fastenings for doors, lids, and the like, so that, when the same are being shut, the end of the spring bolt comes in contact with the said wheel or roller on the stile or bar of the keeper, which wheel or roller, then revolving freely, causes the bolt to recede into the case of the lock, and then spring forward into its place in the keeper more easily, pleasantly, and certainly than with the ordinary keeper bar operating by friction only upon the spring bolt. *Patent abandoned.*

229. J. Fyfe. *Improvements in safety apparatus for steam boilers.* Dated January 26, 1863.

In one modification of this apparatus, there is a chest of a rectangular or other convenient form, arranged to be secured to the outside of the boiler in such a position that the proper water surface line may cross it about the middle of its height. A pipe and stop-cock connection is formed between the top of this chest and the steam space of the boiler, and a similar connection is formed between the bottom of the chest and the water space of the boiler. The water level in the chest will thus be the same as in the boiler. To the front of, and communicating with, the chest, there is applied a glass level or gauge tube of the ordinary kind, with a blow-off cock at the bottom. To the upper part of the chest there is fitted a pressure gauge of any convenient kind, whilst upon the top of the chest there is fitted an alarm whistle, or other convenient alarm instrument, arranged to be worked by steam. The bottom of the chest is provided with a valve seat upon the inlet opening of the water-connection with the boiler, and a valve to close the opening is suspended to the float inside the chest. A rod passes upwards from this float, and its upper end is shaped to close the opening communicating with the alarm above. The float rod is also jointed to a lever centred on to a stud or arm, and from the opposite end of this lever is suspended a second float, which is altogether in the steam when the water level is at its proper height. If the water level becomes too low, the alarm valve is opened by the descent of the lower float, and, if the water level rises, it first closes the alarm valve by the buoyant action of the lower float; but on its rising so as to act on the upper float, the action is reversed, and the alarm valve is opened as before. Another valve is arranged in connection with the alarm, and this valve is loaded to the pressure which it is wished not to exceed, so that, on that pressure being passed, the steam passes through the valve and sounds the alarm. *Patent abandoned.*

230. A. Lietout and J. B. Roisin. *Improvements in gymnastical apparatus for medical purposes.* Dated January 26, 1863.

This apparatus consists, chiefly, of a solid rectangular frame, which may be at pleasure either firmly secured to the floor in the vertical position or rest on legs in the horizontal one. In this frame a moveable panel, to which a moveable arm or other chair may be fixed, is allowed to glide up and down or forward and backward in suitable grooves or slots, the panel being kept in equilibrium by means of a counter weight or spring, handles being inserted in a fixed panel for allowing the person sitting on the chair to cause his body and the chair either to ascend or descend, and perform other gymnastical motions counteracted by suitable springs or other elastic bodies, and thus give proper exertion to the principal muscles and moveable articulations of the body, either in the horizontal or the vertical position, whilst rope or other ladders or other gymnastical implements are applied to the standards or uprights of the frame, and even a small apparatus be added for exerting the muscles of the fingers and the hand, which apparatus is arranged in a manner similar to a piano key-board, but with its keys counteracted by suitable springs. *Patent completed.*

231. R. A. Brooman. *Improvements in petticoats or crinolines.* (A communication.) Dated January 26, 1863.

This invention consists in making petticoats of linen, cotton, or other material, cut by preference on the bias, and made to set full at the back by ribbons or strips of steel or other metal, the ends of which are connected to a metal or other hoop carried all round and forming the bottom of the petticoat. With the exception of this bottom hoop there are no hoops or rings round the petticoat, the ribbons or strips of steel or other metal extend diagonally from the hoop at the bottom of the petticoat on one side upwards, and are brought down diagonally and secured to the hoop on the opposite side. The petticoat may be made to open in front, and the sides secured by buttons or other fastenings. *Patent abandoned.*

232. H. H. Henson. *Improvements in fabrics for covering floors, walls, roofs, and other surfaces or objects, which fabrics are also partly applicable to the manufacture of waterproof articles.* Dated January 27, 1863.

One part of the present invention consists in an improved combination of the compounds of india rubber, gutta percha, or substances having similar properties, and cork dust, peat dust, ground leather, ground tan, flock, oxidized oil, boiled oil, gums, resins, umber, litharge, or other similar or fibrous materials, with a certain class of woven, plaited, or netted fabrics of considerable strength and substance, such as cocoa-nut fibre or other matting, the plastic or other compound being applied as an outer coating to one or both sides of the textile fabric. Another part of the invention consists in manufacturing a new fabric consisting of any of the before-mentioned compounds of india rubber, gutta percha, or similar substances, with other materials such as pigments, for forming the under surface of any suitable woven, textile, felted, netted, or other fabric, such as the fabrics called "scrim," "canvas," or "hessian," and any compound of oxidized oil or boiled oil for the upper surface, or *vice versa*, such compound of ozidized or boiled oil being formed by boiling with the oil any description of gums or resins, in greater or less proportions, with an admixture of fibrous or other materials, such as cork dust, peat dust, ground leather, ground tan, flock, litharge, umber, and other pigments, according to the purpose to which the fabric is to be applied. Another part of the invention consists in manufacturing "kamptulicon" of two layers, of which the lower layer is composed of a mixture of Trinidad pitch, india rubber, gutta percha, and cork, whilst the upper layer is composed of india rubber, gutta percha, or similar substances or compounds of oxidized oil or boiled oil, with gums or resins, with the admixture of such materials as are capable of receiving dies, such as flock, cocoa-nut fibre, dust, leather, waste, ground tan, hair, wool, or other similar material. *Patent completed.*

233. G. Davies. *Improvements in preserving provisions and in the apparatus employed in such purposes.* (A communication.) Dated January 27, 1863.

The first part of this invention consists in causing a current of electric fluid to pass through the cases containing the provisions after they are finally closed up; such electric fluid, being made to pass along a fine iron or other metallic wire through the case, causes the wire to become red hot and consume the oxygen. Another improvement consists in placing inside the case (and in connection with the thin wire) any known chemical agent (such as common sulphur for instance), which, in its ordinary state, has no particular affinity for oxygen, but which upon becoming ignited (by means of the electric wire above referred to) evolves any gas (sulphurous acid gas for instance) which will absorb, destroy, or convert into a harmless gas the oxygen which is contained in the case, and which it is desired to get rid of, or the sulphur or other agent may be ignited by any other convenient means. A further improvement in connection with the use of electricty for this purpose is as follows:—After the case has been closed, a sufficient quantity of hydrogen gas is to be introduced therein to form (with the oxygen that may be in the case) an explosive mixture or gas, and this gas is to be then ignited by passing a current of electricity along a metallic wire through the same, and thus all traces of oxygen will be destroyed. *Patent abandoned.*

234. W. Gilpin and J. Kraft. *Improvements in fastenings of umbrellas and parasols.* Dated January 27, 1863.

According to this invention, a fastening is effected which holds the umbrella or parasol in position, whether the same be expanded or closed, by means of a stud fixed in the stick of the said umbrella or parasol, and also of a groove or slot cut in a runner revolving on the stick, and to which runner a notch carrying the ribs of the umbrella or parasol is attached. *Patent abandoned.*

235. C. F. Ash. *Improvements in the manufacture of cornices, joints, and laths of bedsteads and other articles of furniture.* Dated January 27, 1863.

These cornices are made of timber or wood of various shapes and designs, over which thin sheet iron or other metal is securely fastened. Another method consists in manufacturing the cornices entirely of sheet zinc or other metals, which are formed of various designs, and which are obtained by stamping or drawing the metal through a suitable machine to give it the configurations required, and which is intended to give a massive appearance, combined with great strength, lightness, and durability to articles so constructed. The joints are formed of a wrought or cast hollow metal block, with recesses, notches, or mortises formed therein of the same shape or section at the ends of the rails intended to be attached, and to which block is attached a bolt or pin with a nut or substance fitted to the same, the bolt or pin being fastened in its place either by casting to a portion of the metal block, or by welding, screwing, soldering, or pinning it in its position. The nut or other substance when fixed in its place enables the inventor to obtain an equal bearing of the rails in conjunction with a more regular strain of the various parts. The side and end rails are so formed at their ends as to fit one over the other, with a hole punched or drilled in each end which allows them to drop vertically over the upright pin or bolt, and fit into the recesses, notches, or mortises formed in the metal block. The bottom or lower portion of the top pillow is provided with a screwed base, and acts as a nut, which upon being screwed to the pin in the block, and coming in contact with the side and end rails, connects the various parts firmly together. Occasionally he attaches the pin in the top member of the post or pillar, and screws the same downwards into a suitable screw nut provided in the hollow metal block with the loose nut or substance, as the case may be. The method of attaching the pillars or posts to the block and screwed base or nut is by casting to or on to the same, or by soldering, welding, pinning, screwing, or wedging to the pillar or post, as the case may be.—*Patent abandoned.*

236. C. Askew. *An improved railway chair and joint for rails on railways.* Dated January 27, 1863.

This chair is constructed in two parts, and each has a head similar to the jaw of a vice to fit the rail; one of such parts has a sliding groove, similar to the slide of a slide rest of a lathe, and the other has a sliding piece to fit and slide in each groove. When a single or double-headed rail is placed between the jaws of a chair, it is secured in the required position by means of one or more bolts passed through one or more holes through the two parts of the chair, and, if desired, through the rail also for that purpose, and screwed up securely by means of one or more screw nuts. *Patent abandoned.*

237. W. Rollason. *Improvements in the manufacture of metallic boxes.* Dated January 27, 1863.

This invention has for its object improvements in metal boxes, cases, or holders for containing lucifer matches and other lights, and for other purposes, and consists in so shaping and forming the plates of which the said boxes are made that the joints at the angles formed by the junction of the sides and ends are self-acting or self-securing, when fitted and pressed together, forming a box or case without requiring the angles to be soldered or otherwise fastened by any additional matter. *Patent completed.*

238. R. A. W. Green. *Improvements in light-rowing boats, usuallg termed wager-boats.* Dated January 27, 1863.

According to this invention, the inventor makes light-rowing or wager boats of a circular form from end to end, and tapering off from the middle to a sharp point at each end, being, in fact, like two cones placed base to base. In building this boat there are four stringers or principal timbers which, with the exception of the upper one, are continued from end to end of the boat. These stringers or longitudinal pieces are united by circular frames or timbers of graduated diameter, according to their position in the boat, the largest being in the middle and diminishing towards the ends. For two of these circular ribs he substitutes two solid discs, one being placed immediately forward of the sculler and the other in the position to act as a stretcher or footboard, or a support for the same. Having so constructed the framing of the boat, he then applies the outside covering, which he makes of a thin surface of cedar. The bottom half of the boat he makes in two pieces, extending from the middle to each end, and so as to enclose half the periphery of the boat. These pieces are butted and lapped or half-checked on each other at the junction. The upper part of the framework he covers in the same way. *Patent abandoned.*

239. J. Edmondson and T. Ingram. *Improvements in looms and apparatus for weaving.* Dated January 27, 1863.

The objects of this invention are—1, To render looms self-acting in finding the shed wherein a broken pick is made, or where the full shoot of weft is not introduced, so that, when the loom stops, the required shed will be ready to receive the weft the next shoot. 2, To cause the change boxes in fancy looms to change only when the required number of picks of any particular colour of weft have been woven, notwithstanding the weft having been broken. 3, To throw any required number of picks or shoots of weft into one shed. 4, In continuous looms, or looms that do not require to stop for change of weft (such as for which letters patent were granted to the aforesaid Thomas Ingram, dated the 4th day of April, 1860, No. 861), to provide for the introduction of the changed weft into the proper shed. 5, In the aforesaid continuous looms to cause the weft so introduced to supplement the broken pick or shoot, or to cause the next shoot to commence at or near the point or place in the shed where the broken pick or shoot terminates, or to take out the broken pick of weft so that there shall not be a double shoot in some part of such shed where a pick or shoot is broken. 6, To lessen the friction in the warp when weaving gauze, leno, or other similar cloth, and to dispense with the easing-rod usually applied for that purpose. 7, To thread the weft mechanically through the eye of the shuttle or weft case. *Patent completed.*

240. T. Gordon. *Damping and affixing postage stamps to letters.* Dated January 27, 1863.

This invention is carried out as follows:—The inventor has a tank or reservoir for water encased in wood, metal, or any other suitable material, forming the base; in this he inserts a cotton with sponge attached, communicating by means of a small tube with a perpendicular square box or cylinder on the top of the base, of which there are two—one on the left and one on the right hand side—elevated by means of four small springs, so as to form openings for the reception of the letter. The left-hand box or cylinder contains the sponge; it has also a piston working in a sliding cylinder which, when pressed—the letter being placed in the opening formed as aforesaid—damps the corner of the letter; the right-hand box or cylinder which is portable contains the stamps; by passing the letter from left to right, and pressing the piston as aforesaid, the stamp is fixed firmly and securely to the letter. *Patent abandoned.*

241. D. E. Hughes. *Improvements in means or apparatus for effecting telegraph communications.* Dated January 27, 1863.

This invention relates—1, to means for regulating or governing the motion of apparatus employed when recording telegraphic communication. Upon one of the main axes of such apparatus the patentee applies a fly or balance wheel; and opposite the end of this axis, but held somewhere inclined to it, he applies an elastic and weighted rod, capable of vibrating in a rotary direction when acted upon by an arm or connection from the main axle refered to. The vibrations thus obtained regulate and render uniform the motions of the apparatus without the necessity of an escapement. The position of the weight on the vibrating rod is capable of being regulated to the speed desired. To prevent breakage of this vibrating rod by the extent of its vibrations a pad or friction surface is brought into operation upon a friction band or surface as the vibrations increase, in order to use up the surplus force exerted. 2, The improvements relate to means for facilitating the ready change from one class or character of recorded sign or indication to another,

as from letters to figures. For this purpose the periphery of the type wheel is arranged with the desired different signs thereon in alternate order, and this wheel is affixed to a hollow shaft or boss which receives the hollow shaft or boss of a correcting or adjusting wheel having teeth on its periphery corresponding with those of one set of signs on the type wheel or the intermediate portions thereof. The outer end of an arm from the axis of the type wheel passes into a recess in a lever turning upon an axis carried by the correcting or adjusting wheel, and this wheel is formed at its opposite ends with projections adapted respectively to fill up spaces opposite those between the teeth of the correcting or adjusting wheel. The pressing in of one end of this lever will cause the teeth of the correcting or adjusting wheel to be coincident with one set of signs on the type wheel, and the pressing in of the opposite end of the lever causes the type wheel to be moved partly round on its axis, so that intermediate signs are then coincident with the teeth of the correcting or adjusting wheel. One or the other end of this lever is pressed inwards at the times desired to effect a change, when the apparatus is set in motion by the passage of a current of electricity brought into operation by acting on one or the other of particular keys corresponding with the relative position of the type and correcting or regulating wheels. The improvements relate —3, when using the power of a permanent magnet in connection with an electro-magnet, in manner of the character described in the specification of letters patent granted respectively to Joseph Camp Griffith Kennedy, bearing date the 11th day of September, 1855, No. 2058, and to the present patentee bearing date the 27th day of April, 1858, No. 938—and consist in connecting the armature through a small local battery to one wire of the electro-magnet, and in connecting the other wire of the electro-magnet with a stud or projection in position to be acted upon by the armature when that is raised. By these means, upon the passage of a current of electricity into the electro-magnet, the armature is at once released, when the current of electricity, in place of continuing through the coils of the electro-magnet, flows by way of the armature, and through the local battery, to the main wire, at the same time the tendency of the local battery is to restore the magnetism in the cores of the electro-magnet. *Patent completed.*

242. W. C. WILKINS. *Improvements in lamps.* Dated January 27, 1863.

To a lamp constructed with a reservoir in its stem or base to contain the matter to be burned, and means for forcing up such matter for consumption, the inventor applies between such reservoir and the burner a small vessel of porcelain, glass, or other suitable material that will not freely conduct heat up to the burner; and he applies cork or other suitable non-conducting material between the upper parts of a receiver and the burner tubes, acting as a receiver for or feed to the lower part of the wick and of the fluid being consumed. This receiver has an overflow for surplus fluid to flow back into the reservoir below. He also applies an internal hollow cone, and an external tubular deflector, the upper or deflecting edge thereof being turned inwards, and at or near the level of the wick tubes, which external deflector he prefers to be of glass, so as to intercept the rays of light as little as possible; over these he applies an external chimney. *Patent abandoned.*

243. H. B. BARLOW. *Improvements in preserving timber, and in apparatus employed therein.* (A communication.) Dated January 28, 1863.

This invention consists in placing the timber in a closed vessel, from which the air is exhausted by suitable air-pump machinery, then subjecting it to the action of a metallic salt, and then to the action of tar or other bituminous substance. *Patent completed.*

244. H. WATSON. *Improvements in the heating arrangements of stoves for drying woven fabrics.* Dated January 28, 1863.

These improvements are advantageously applicable to stoves of the kind used for Turkey-red fabrics. A stove of this kind consists of a building of one, two, or more storeys or flats; the floors in the case of two or more flats being permeable to the heated air or vapour. The heat is applied to the bottom or ground floor by means of a horizontal flue proceeding from a furnace at one end, and returning backwards and forwards across or along the floor a number of times until it finally reaches the chimney or stack. As hitherto arranged, the heat radiated in a downward direction is completely lost, and it is the object of the present invention to recover and utilize a large portion of that otherwise waste heat by constructing under the main flue an air flue or passage discharging itself into the main flue behind the fire-bridge, or at any other suitable point or points. *Patent abandoned.*

245. T. PANKINSON. *Improvements in carding engines.* Dated January 28, 1863.

This invention has for its object the combing of the cotton from the doffers of the machines known as carding engines, and consists in attaching the comb by means of two or more arms or levers to an oscillating shaft, which receives motion from a revolving shaft containing a crank or eccentric by means of a rod and lever. This revolving shaft has motion given to it by wheelwork, either direct from the shaft which drives the delivery rollers, or from the driving wheels connected thereto; or it may be driven by bands and pulleys from any convenient part of the machine. The revolving shaft actuates the oscillating shaft by means of the said crank or eccentric and a rod or lever, thereby giving the comb an oscillating motion, so as to remove the cotton from the doffer. *Patent abandoned.*

246. W. E. GEDGE. *Improved machinery or apparatus for fastening by screws boots, shoes, and other articles composed of leather.* (A communication.) Dated January 28, 1863.

This invention is not described apart from the drawings. *Patent completed.*

247. E. F. PRENTISS and J. C. SELLARS. *Improvements in treating rock oil, petroleum, paraffine oil, coal oil, and other like mineral oils and products therefrom.* Dated January 28, 1863.

This invention has for its object an improved system of treating petroleum or rock oil, paraffine oil, coal oil, paraffine, and other like mineral oils, and the products therefrom, and consists in combining them with resin, resinous, or other gums, and tallow and other fatty matter, to improve the quality of these substances, to better adapt them for burning, lubricating, detergent, and other purposes. When required for detergent purposes, it is preferred to saponify the compounds by the addition of any of the alkaline substances used for that purpose. *Patent abandoned.*

248. J. OGLESBY, J., W. M., and J. DICKINSON, jun. *Improvements in apparatus for steaming, cooking, and generating gas.* Dated January 28, 1863.

This invention is not described apart from the drawings. *Patent completed.*

249. H. O. COOK and E. G. TERREY. *Improvements in propelling ships and vessels, and in apparatus employed therein.* Dated January 28, 1863.

The patentees claim a method of propelling vessels by means of rotating fan or windmill sails, in connection with certain gearing, and a screw propeller or paddle wheels, substantially in the manner specified. *Patent completed.*

250. C. MACE. *Improvements in steam engines for propelling vessels and for other purposes.* Dated January 28, 1863.

The main bed of this engine is formed into a hollow box frame of a suitable form, and of sufficient size to receive the arrangement of horizontal tubes of a surface condenser. In this condenser the tubes are placed horizontally, but slightly inclined, and the tubes in each are disposed in a line with the keel (when used for ship propulsion) and, consequently, with the driving shaft of the engine. It is preferred that the circulation of the condensing water should be by mechanical means, and through the thin metal tubes of the condenser, whilst the steam is brought in contact with the exterior surface of such tubes; but this action may be reversed. The condensers form the bed of the engine, and the hollow columns which rise above and are fixed to the condensers, form the supports of the cylinders. The air-pumps are formed in the columns that support the cylinder, and are worked from cross-heads either above or below the cylinders; the pump rods work through suitable stuffing-boxes. *Patent completed.*

251. R. WARD. *Improvements in locking-up or fastening forms of type or other printing surfaces.* Dated January 28, 1863.

In place of a series of "quoins" or loose wooden wedges acting upon a "side-stick" or "foot-stick," the patentee employs two (though it is not absolutely necessary to use two, as the result may be accomplished by one) side-sticks or foot-sticks, with their bevelled edges turned towards each other, and between these he places a continuous wedge (or a series of united wedges forming one piece) of iron, or other suitable material or materials, which is fixed and kept in its place by means of a screw acting upon a square or suitably-shaped piece of iron placed in the corner of the chase, so that it will bear the pressure of the screws of both the bottom and the side wedges. *Patent completed.*

252. F. W. WYMER. *Improvements in steam engines.* Dated January 28, 1863.

For the purposes of this invention, two cylinders are used—one, the smaller cylinder, is a high-pressure cylinder, whilst the other, the larger cylinder, is a low-pressure cylinder—combined in such manner that the steam from the high-pressure cylinder is passed into and expanded in the larger cylinder, as is well understood. It is preferred that the larger cylinder should be the lower one of the two, and that the smaller cylinder should be formed on the upper end or cover of the larger cylinder. The piston rod of the smaller cylinder passes through a stuffing-box in the cover of that cylinder, and is fixed to the middle of a cross-head. The piston in the lower and the larger cylinder has two piston rods which respectively work through stuffing-boxes formed in the upper end cover of the larger cylinder, in such manner that the piston rods are outside of the smaller cylinder, and their ends are fixed to the ends of the cross-head above mentioned. There are also two piston rods to the piston of the larger cylinder, which descend through the lower end cover, and work through stuffing-boxes formed therein. The lower ends of these two piston rods are fixed to a cross-head, the ends of which slide or move between guides fixed to the columns or hollow supports on which the larger cylinder is fixed. These columns or hollow supports are to be constructed and arranged in a suitable manner to act as condensers, either by injection or surface condensation. The hollow columns or supports are fixed to a suitable bed plate, and the main or driving shaft of the engine is placed between the columns or hollow supports. Motion is communicated to the driving shaft by means of a connecting rod from the lower cross-head, from which also motion is communicated by a beam or lever to the air and water pumps, which are, by preference, arranged on the base plate outside of the columns or hollow supports. *Patent completed.*

253. J. PLATT. *Improvements in rotary engines.* Dated January 28, 1863.

For the purposes of this invention, a cylinder is mounted and fixed to an axis or shaft by means of one of its ends or covers. The cylinder is placed within a cylindrical or other suitable form of cover or case, which is arranged to act as a framing. It is preferred that this case should be constantly full of steam when the engine is being worked by steam. Part of the shaft or axis, and the cylinder thereon, are arranged to rotate with the case or cover, whilst parts of the shaft or axis pass through and are supported in suitable bearings at each end of the cover or case. One of the end covers of the cylinder is made with two hollow chambers, one on each side of the shaft or axis, to receive two slides which are alternately moved into and out of the cylinder of the engine by means of a stationary fixed undulating track or cam, in which a roller at the end of each of the slide rods moves. The undulating track or cam is fixed to a hollow trunk, which passes from the exterior into the interior of the case, its inner end coming against the end cover of the cylinder of the engine, which is fixed to the shaft or axis. The hollow trunk is divided into two parts or compartments; one acts as the steam pipe or passage for conveying steam to the interior of the cylinder of the engine when the engine is worked by steam, and the other compartment constitutes the steam outlet from the cylinder of the engine; but the use of these two compartments or divisions of the hollow trunk may be changed or reversed by a suitable slide or other valve. A steam stop is formed or fixed in the end of the hollow trunk, which forms a steam abutment within the cylinder of the engine, and it is between this fixed stop or abutment and one of the slides the steam is introduced into the cylinder of the engine, whilst the steam is allowed to escape from the cylinder of the engine into the outlet compartment on the other side of the slide. The slides, as they pass the abutment or stop, are by the cam or undulating track caused to enter the cylinder in such a manner as to be acted on by the steam, and to be propelled thereby from the steam stop or abutment, so as to communicate a rotary motion to the cylinder and the axis or shaft of the engine to which the cylinder is fixed. The steam or abutment is packed with metallic packing formed with inclined surfaces, which packing is capable of being set up by a screw, which can be turned from the outside of the case. The engine may be worked by other fluid as well as by steam; and by applying power to the shaft or axis, so as to give a rotary motion to the cylinder, the engine will become a pump. *Patent completed.*

254. W. CONISBEE. *Improvements in cylindrical chromo-lithographic printing machines.* Dated January 28, 1863.

This invention is not described apart from the drawings. *Patent completed.*

255. S. W. FRANCIS. *Improvements in revolving shutters.* Dated January 28, 1863.

These improvements consist in so constructing the laths or plates of revolving shutters that such shutters may revolve in either direction round the roller to which they are attached; and for this purpose the patentee forms a groove in the bottom or lower edge of each lath or plate, and along the entire length of each lath or plate of which the shutter is composed (except the bottom lath of each shutter), and he constructs the upper edge of such lath or plate thinner than the lower edge thereof to fit into the groove in the lower edge of the lath or plate immediately above it. He then unites the several laths or plates of which the shutter is composed by means of belts, webs, chains, cords, or wires, passed through holes or mortises in the breadth of each lath or plate in the usual manner. *Patent completed.*

256. W. CLARK. *Improvements in the means and apparatus for copying and reproducing sculpture and other objects of art.* (A communication.) Dated January 28, 1863.

This invention relates to an improved process termed photo-sculpture, which is based on the employment of photography in connection with the pantograph. By this improved process the patentee can produce sculpture exactly similar to the model, whether living or otherwise, with much greater rapidity, at a less cost, and by the aid of persons having no previous knowledge of the art. He can further lessen the time necessary for the sitting, and produce sculpture of larger or smaller dimensions than the original, or in any other proportions desired. This invention cannot be described without reference to the drawings. *Patent completed.*

257. J. H. JOHNSON. *Improvements in the manufacture of braid, and in machinery or apparatus employed therein.* (A communication.) Dated January 28, 1863.

This invention relates—1, to an improved manufacture of flat braid, and consists in making such braid with the borders or selvages thinner than the body or central portion thereof. The second portion of this invention relates to certain peculiar constructions and combinations of parts of braiding machines, whereby the productive powers are greatly increased, whilst the work executed is superior to that produced in ordinary braiding machines. According to this part of the invention, it is proposed to make the spindles or bobbin carriers in such a manner as to admit of the bobbins being easily lifted off with such parts as hold the threads in their different directions without disturbing such threads, whereby facility is afforded for changing a deranged bobbin by simply replacing it by one in perfect order. *Patent completed.*

258. C. P. STEWART and J. ROBINSON. *Improvements in, and applicable to, that apparatus known as Giffard's injector, and in the adaptation of it to locomotive and other boilers.* Dated January 28, 1863.

There are certain objections in Giffard's injector, and, by discoveries which the patentees have made, they are enabled to remove them—that is, they can stop the noise when working, prevent the admixture of air with the water passing through the injector, and the loss or waste of water escaping from the overflow cavity, and arrange so that the working of the apparatus can be brought more easily under the inspection of the driver or fireman in locomotive and other boilers, and, besides removing these objections, they can feed cold or hot water at the overflow cavity. Some or all of the objections are removed and the above advantages are secured by each of the improvements hereinafter described. The improvements consist in forming a cavity around and above the nozzles of the injector as a reservoir for a portion of the overflow water. The improvements also consist in applying a pipe to the overflow, so that the water therefrom will have to ascend the pipe, which is open to the atmosphere at its upper end; or the pipe is first made to ascend, and then descend, its lower end being immersed in water; or it is bent down and immersed in water. The invention also consists in connecting the overflow orifice with the suction pipe, supplying water to the injector, and placing a two-way tap between the overflow and suction pipe, so that when the communication is shut between the two, the overflow will be open directly to the atmosphere,

and when the overflow is shut to the atmosphere, it will be open to the suction pipe. The improvements in arrangements for applying the injector to locomotive and other boilers, so that its working will be better under the inspection of the driver and fireman, consist in connecting the overflow orifice with the suction pipe, and fixing a tap to open or shut the communication between them, and in joining a branch pipe to the connecting pipe, so as to ascend from it, the upper end being open to the atmosphere. *Patent completed.*

259. E. G. Muntz. *Improvements in securing axles and axle boxes.* Dated January 28, 1863.

In carrying out this invention, the patentee forms upon an axle the half section of a groove running round or partly round the axle, the counterpart of this groove being formed on the inside periphery of the box; an opening somewhat larger in diameter than the section of the entire groove is cut in the box inclining towards the groove; this opening has a flange round the orifice, reducing its diameter at that part, and forming a collar, the axle and box being fitted together with the grooves in opposition. A plug of india rubber, or other flexible material, furnished with a ring or knob at one end, below which is a projecting collar formed on the plug, is inserted in the orifice in the box, and winds itself round the groove in the axle and box, being prevented from escaping by the collar upon the plug impinging against the flange or collar formed in the opening by which it enters. The flexibility of the material of which the plug is formed allows of its being withdrawn by force when required. *Patent completed.*

260. H. Crichley. *Improvements in reaping and mowing machines.* (A communication.) Dated January 28, 1863.

This invention is not described apart from the drawings. *Patent completed.*

261. B. A. Branwich. *An improved mode of obtaining and applying motive power.* Dated January 28, 1863.

This invention relates to a novel mode of applying compressed air to the obtaining of motive power. To this end the patentee provides a chamber capable of containing the compressed air to be employed, and in connection therewith he brings a series of engines, which he proposes shall, each in turn, receive the air as it leaves the chamber, and be acted upon thereby. These several engines he proposes to connect with a common shaft, and thus to concentrate the power of all the engines. A convenient mode of carrying out this system is to construct a series of annular cases, and to fit air-tight covers thereto, but in such a manner that they will be free to rotate on their seats. To the inner face of these covers a piston is attached, which fits the case, and each case he provides with a supply and discharge pipe, between which he mounts a valve which is maintained in position by a spring or other suitable means. This valve acts as a stop to the admitted air, but will yield to the pressure of the piston, so as to allow it to pass in its rotary course. This series of rotary engines he mounts one above the other in suitable fixed framing, and sets up a vertical shaft concentric therewith. From the shaft project arms, the extremities of which are connected to the rotary covers of the engines. As, therefore, the engines are driven, they will severally exert their power in driving the common shaft, from which rotary motion may be taken off by a crank or otherwise. The engines are connected together by coupling pipes, and the top engine of the series is also connected by a supply pipe with the air chamber. The air therefore passes first to the top engine, when, having exerted its force, it goes to the next, and so on through the series, until, having operated on the piston of the last engine, it enters an elastic coiled pipe, which is connected to the air chamber. A pressing roller, driven by the central shaft, traverses this coiled pipe, and expels the air therefrom as it is supplied thereto, driving it into the chamber. Thus the same air is used again and again for driving the engines. At starting the compound engine, any available motive power may be employed for charging the air chamber with compressed air. *Patent completed.*

262. H. A. Bonneville. *Improvements in the construction of granaries.* (A communication). Dated January 29, 1863.

This invention is not described apart from the drawings. *Patent completed.*

263. J. A. Weston. *A new or improved coupling and break for transmitting, or regulating, or arresting motion.* Dated January 29, 1863.

The patentee claims a coupling and break consisting, essentially, of two series of discs, the discs of one series being incapable of rotation except with one of the two axles or other bodies to be ungeared from one another, and the discs of the other series being incapable of rotation, except with the other of the said axles or bodies; the discs of each series alternating with those of the other series, and the whole of the discs capable of a sliding motion in the line of their axles, so that they may be either separated from one another or pressed against one another, so as to produce the amount of friction which is necessary for communicating the motion of one series of discs, or for enabling one series to regulate or arrest the motion of the other series. *Patent completed.*

264. J. B. E. Louit. *Improvements in glass chimneys.* Dated January 29, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

265. J. Mackenzie. *Improvements in shaping machines for curvilinear surfaces.* Dated January 29, 1863.

This machine has the bed and frame of an ordinary planing, boring, and shaping machine, the traversing motion of the saddle and that of the bed being produced in the usual way. The cutter block is mounted upon an axle or spindle, and is either forged with it or keyed on to it, and the cutters are fixed to it in the customary manner. By means of bevel-gearing connected with the cutter block and its axle the patentee is enabled to give them an angular motion in a vertical plane, thus enabling him to shape or form curvilinear or bevel surfaces. *Patent completed.*

266. R. A. Brooman. *Improvements in the manufacture of candles.* (A communication). Dated January 29, 1863.

The objects of this invention are to obtain a brighter and more uniform light, and to prevent guttering in candles. The invention consists in the employment of a hollow or tubular wick to produce a current of air to the centre of the flame. For candles intended to be burnt in sockets or holders, which will not allow a current of air to pass through the bottom of the candle, the inventor forms an aperture or passage through the side of the candle above the socket or holder and communicating with the interior of the wick. During the manufacture of candles according to this invention he passes a spindle or rod through the wick to keep it open. *Patent completed.*

267. J. Pouncy. *Improvements in obtaining, transferring, and printing from photographic pictures or images, also in preparing materials for same.* Dated January 29, 1863.

The principal feature of this invention consists in the employment of a sensitive or sensitized ink or composition on which pictures or images may be produced by the agency of light, and which may be transferred or printed from in the manner described. *Patent completed.*

268. W. Ball and J. Wilkins. *Improvements in machinery employed in the manufacture of looped fabrics.* Dated January 29, 1863.

For the purposes of this invention, a needle bar, a presser bar, and a sinker bar are used, as in warp machines. Two guide bars are also employed, each bar having half as many guides as there are needles; these guide bars have simply a shogging or to-and-fro endway movement equal to three needles constantly communicated to them in opposite directions by lace wheels or otherwise, and the threads of these guides are constantly laid to and fro under three needles, excepting when they are intercepted by suitable interceptors, which are preferred to consist of forked rods, acted on by jacquard or other pattern surfaces. The bar which carries these forked interceptors has a shogging motion equal to the space between two needles, and there are half as many interceptors as there are needles. So long as the interceptors are not brought into action, the threads of the two guide bars are constantly shogged a distance in opposite directions equal to three needles, but when any of the interceptors are brought into action, they each receive in their forked ends two of the guides, and prevent them shogging to the full extent of their otherwise constant action. A third guide bar is also used, the threads of which are caused to lap on to the needles, and to be looped thereby, so as to form as many looped pillars as there are needles. The guides of this guide bar are cranked towards the needles, and there are as many upright points with eyes or holes through them near their upper ends as there are needles, so that the threads pass through such holes or eyes in the upright points, and then through the holes or points in the guides. The guides and points of this third guide bar rise up through the threads of the other guides, and are then caused to be shogged, so as to lay their threads on the stems of the needles; but before this rising of the guides and points and the lapping of the threads on to the needles takes place, points on a suitable point bar are caused to come forward, and to draw the threads which have been traversed under the needles in towards the work, so that when the threads of the guides of the third guide bar come up, they shut the traversed threads into the fabric. The threads which lap over the needles are by the working of the machine caused to be moved under the beards of the needles, and the work is knocked over the heads or ends of the needles by the needle bar being caused to move back, the heads of the needles being closed by the needle bar, as is well understood. *Patent abandoned.*

269. J. Nadal. *Improvements in fountains.* Dated January 29, 1863.

This invention has for its object improvements in fountains. For these purposes, an upper and a lower vessel are employed, which are combined together by a suitable stem or pillar. It is preferred that the upper vessel should be in the form of a basin, while the lower vessel should be in the form of a base, and that they should be combined by a stem or pillar; but other devices or forms of vessels may be employed. The upper and lower vessels are both closed. In the upper part of the upper vessel is a jet pipe, which descends to nearly the bottom of such upper vessel. There is also another pipe descending from the upper part of the upper vessel down through such vessel, through the stem or pillar, and down into and nearly to the bottom of the lower vessel. This pipe may be called the supply pipe, as it is by this pipe that water or other fluid is supplied to the lower vessel, and by which also the water or other fluid coming from the jet or jets descends into the lower vessel. The upper vessel is supplied with water or other fluid by removing the jet pipe. In addition to the above-mentioned pipes, there is also another pipe which, by its lower end, is fastened to the top of the lower vessel, and it ascends through the upper vessel nearly to the top. By these means, supposing the upper vessel to have been filled with water or other fluid, on pouring a quantity of water or other fluid into the supply pipe, such water will press on and displace the air in the lower vessel, and cause it to ascend into the upper part of the upper vessel, and thus cause the water or other fluid therein to be driven through the jet pipe, and a continuous action will take place so long as there is any air to be driven into the upper vessel. *Patent abandoned.*

270. N. Clayton and J. Shuttleworth. *Improvements in thrashing machines.* Dated January 29, 1862.

According to this invention, the grooves or channels are formed parallel to each other longitudinally along the face of each beater, not, however, in straight lines as heretofore, but in serpentine lines. It is preferred that each beater of the drum of a thrashing machine should be formed with three serpentine grooves; this number is not, however, essential, as the number of the grooves or channels in the face of a beater may be varied. The whole of the grooves or channels, although they are parallel to each other, and formed in a longitudinal direction along a beater, do not in consequence of a beater having parallel sides all pass from end to end of a beater, but only some of them, whilst others only extend along a comparatively short length of a beater. *Patent completed.*

271. C. H. G. Wilbany. *Improvements in the manufacture of red colouring matter.* Dated January 29, 1863.

In order to produce a red colouring matter suitable for dyeing and printing, the patentee heats two equivalents of aniline, or its homologues, and one equivalent of phosphate or acetate of mercury. It is preferred that the aniline or its homologues should be in combination with acetic acid, as acetate of aniline (or of a homologue thereof); or it may be combined with hydrochloric acid, nitric or sulphuric acid, as a hydrochlorate, nitrate, or sulphate; or the aniline or its homologues may be employed in an uncombined state, or partly in the state of a salt and partly in an uncombined state. *Patent completed.*

272. A. Pritchard. *An improved method of preserving the contents of packages from air, water, or damp.* Dated January 29, 1863.

The materials to be packed are first to be made up into packages or packets of any convenient form and size, the coverings or outsides whereof may be of paper, chip, wood, or any other suitable material, which packages or packets are to be dipped or immersed in a boiling composition (which the patentee terms alkareen or alkarene) composed of asphaltum, coal tar, or coal pitch and soft pine pitch boiled together, which composition when applied forms a hard glossy enamel on the surface of the packets capable of resisting alkalies, air, water, or damp. *Patent completed.*

273. G. Blake. *Improvements in heating aparatus for heating and warming.* Dated January 29, 1863.

This invention relates to the construction of stoves of corrugated or waved or zigzaged iron (or other suitable metal) or fire-clay. A fire placed inside the improved stove is the usual source of heat; but steam, hot water, or a gas flame are applicable. In the first place, the patentee prefers to use plain sheets of iron to form the case, to which the corrugated iron or material is fastened by means of rivets, bolts, or otherwise, such corrugated iron or material deriving its heat through the case of the stove, partly by radiation, and partly by conduction: but these stoves may be constructed without such cases of plain sheets of iron when the corrugated iron or material forms the case, deriving its heat directly from the fire or furnace. In this form the corrugated stove may be constructed of fire clay (burnt in the usual way), or of cast iron or wrought iron. *Patent completed.*

274. W. Clark. *Improvements in the condensation of steam and in apparatus for the same.* (A communication.) Dated January 29, 1863.

This invention is based on the following principles:—1, To project the water on the outside of the surfaces in contact with the steam to be condensed, instead of injecting the water into the condenser, and mixing it with the steam. By rapidly renewing the water thus obtained, the inventor remedies the defective conductibility of the water; hence, he requires apparatus of but small dimensions compared with those ordinarily used. 2, The condensing surfaces are disposed in the form of a diaphragm in any suitable manner, but the essential feature of that which is here expressed by the word diaphragm is, to present surfaces accessible on both faces by simply opening a port or removing a cover, and this arrangement, which constitutes the fundamental principles of the system, permits of cleaning the surfaces with ease, even when in motion; it has also the further advantage of allowing free expansion, and preventing all escapes. 3, The distilled water is separated from the fatty matters employed in lubricating the different parts of the machinery, so as to furnish the waters perfectly pure to the boilers. 4, To restore to the distilled water passing from the condenser to the boiler, and from the boiler to the condenser, any quantity which may escape, without any increased attention on the part of the driver or stoker. *Patent completed.*

275. J. Sainty. *Improvements in feeding troughs for sheep and other cattle.* Dated January 29, 1863.

According to this invention, the inventor makes the body of the trough of galvanized sheet iron, which he bends of a cylindrical form, but uses only a section thereof, unbracing rather more than half the circumference. This body he mounts between two cast-iron ends having suitable grooves or projections to receive the ends of the body; these ends are connected by stretcher bolts which connect the whole firmly together. He disposes one stretcher below the bottom of the trough, while the other two pass through heads turned on the edges of the trough, which thereby form round lips or edges thereto; suitable feet are rivetted on to the ends to raise the trough from the ground. By forming the trough of rather more than half a cylinder, the upper parts or edges are turned inwards, which prevents the sheep or other cattle from dispersing the food over the edges, and also prevents the wind blowing it out. Stays are placed across the mouth which serve for hand holds, and also to prevent the cattle dispersing the food and throwing it out; the ends of these stays pass through just below the beaded edges, over which they are turned and bind the sheet iron on the stays. *Patent abandoned.*

276. F. G. Stuber. *Improvements in the construction of air-tight boxes, cases, cupboards, and similar vessels.* Dated January 29, 1863.

This invention consists in the construction of air-tight boxes, cases, cupboards, and similar vessels, in which valuable materials may be preserved from damage by water or moisture, and perishable substances have their decay retarded or arrested by being surrounded by an atmosphere different in condition or nature from the ordinary atmosphere. These vessels are not to be assumed air-tight, but proved to be so, and a test tube or collar is placed somewhere in the vessel for connecting apparatus to the vessel for doing so. The vessels are constructed of metal, or woo

and metal, and vulcanized india-rubber, or other elastic material, which should be vapour-tight, is interposed between the door or lid of the vessel and the vessel itself. Some or all of the fastenings should be modified so as to be readjustable without removal, and to give the necessary pressure upon the lid without adding to the weight. *Patent completed.*

277. J. W. BRANFORD. *The purposes of hoeing and cleaning the land, and for cutting and setting out the plants of lost crops at certain distances from each other, and which invention he designates a longitudinal and transverse hoe.* Dated January 30, 1863.

This invention consists of an implement with two travelling wheels, to be drawn by one horse, having a bar affixed to the frame, upon which are placed four hoes for cutting the ground longitudinally; also an iron shaft with two driving wheels turning two pinions with shafts, to which are attached two iron plates with four knives or hoes on each for cutting or setting out the plants, working in a transverse direction. There are levers for striking the gear and lifting the hoes out of work, and also the travelling wheels, and a pair of shafts to which the horse is harnessed for drawing the implement. *Patent abandoned.*

278. W. E. GEDGE. *Improved apparatus for cleaning chimneys and other flues.* (A communication.) Dated January 30, 1863.

This apparatus is composed of a given number of iron rods fitted at their lower ends in a block of wood; these rods have small scrapers on their tops. On opening out the assemblage of rods or wires (which is effected in the chimney fan-wise but circular) these scrapers perform their office on the inside of the chimney. When not in action they are enclosed within four pieces of wood, surmounted by a hinged platform with wheels. By means of a rod which slides in the supports of the platform—and to which supports are attached four chains, the ends of which are united on the top of the said rod, and a chain passing downwards from the bottom of the rod—the apparatus is opened out when required. *Patent abandoned.*

279. W. E. GEDGE. *Improvements in cones or forms for moulding refined sugar.* (A communication.) Dated January 30, 1863.

Instead of making the cones or forms for moulding refined sugar in the ordinary manner, the cone, the subject of this invention is made of a single piece of sheet iron, of which the edges are tapered or thinned down so as to present, on the outside, as little ridge or waviness as possible. The interior of the cone is perfectly smooth, and the two edges of the iron are first adjusted by small rivets, the heads of which are filed or otherwise smoothed down; then the joint is soldered or brazed with the usual brass and zinc soldering. *Patent abandoned.*

280. J. COCKER. *An improved turnstile, especially applicable to omnibuses and other vehicles to show or indicate the number of passengers that have been carried.* Dated January 30, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

281. N. P. O. LLOYD. *Engines of any desirable power to be worked without the aid of steam, heat, or any auxiliary other than atmospheric pressure.* Dated January 30, 1863.

This invention is carried into effect as follows:—A metallic tube or cylinder is to be inserted at a right angle into a square or otherwise-formed metallic plate, and a metallic rod or bar is to be inserted at a right angle into a corresponding plate, and these plates are to be united by means of a hinge which will permit them closely to approximate or to separate at a necessary distance. The sides attached to these plates will, when the plates are separate, be air-tight by means of appliances connected with the sides and similar substances above and below them. This apparatus may be termed No. 1. Another apparatus similarly constructed and termed No. 2, will be used. The tube of No. 1 and the rod or bar of No. 2 will pass through apertures provided with air-tight substances, in one side of a cubic or elongated metallic air-tight box or chamber, from which air will, through a stop-cock by means of an air-pump, be extracted. The bar of No. 1 and the tube of No. 2 will pass through apertures provided with air-tight substances in corresponding parts of the opposite side of the chamber; a stop-cock connected with the tube of No. 1 being opened will admit air between the metallic plates. The air will force No. 2 (being connected with No. 1 at the air-tight receiver) through the chamber, and will raise No. 1 to the position it occupied while quiescent, and cause the rod of No. 2 to pass without the chamber. The air in No. 2 will, by means similar to those provided for No. 1, be removed into a similarly placed receiver. The air that passed into the receiver of No. 1 will, by means of a hinge, cause the plates closely to approximate and remove the air between the plates into the receiver whence it was obtained; hence, air admitted alternately into each receiver, will move the united apparatus 1 and 2 in alternate opposite directions. Two tubes and two bars being alternately forced within and without the chamber, and being connected with the right and left wheels of the engine and the first carriage or other machinery, will act with double power. *Patent abandoned.*

282. W. E. NEWTON. *Improvements in couplings for railway carriages.* (A communication.) Dated January 30, 1863.

The object of this invention is effected by the employment of spring catches placed within the coupling boxes, and which catches, retain, and hold back the draw-rod or box, which is provided at each end within an inclined projecting piece, so that, when the end of the rod is inserted, it will lift up the spring catch and pass under. These spring catches work in vertical grooves, and the stem of the catch passes through the top of the box, and is provided with a ring or hook, whereby the catch may be drawn up when it is to release the draw bar. Swells or protuberances are made on the sides of the draw bar near its ends, so that, should the carriage be thrown off the rails, the angle that the draw bar will then be made to deviate from a straight line will cause the swells or protuberances to lift up the catch and release the bar. The rear of the coupling box is provided with a rod which passes into another box and acts on a draw spring made of vulcanized india rubber, which may be compressed in either direction, that is whether the carriage be driven forward or pushed backward. *Patent completed.*

283. W. E. GEDGE. *Improvements in hair nets.* (A communication.) Dated January 30, 1863.

This invention consists in the use of human or animal hair exclusively in the manufacture of nets intended to hold or secure in position a lady's hair or coiffure. As regards their manufacture, it is only necessary to observe that the network is best made with the hairs two and two spade-headed, "tête bêche," twisted together, and when the net is completely made, it should be vaporized on a suitable vaporizer to give it finish and fix the knot. *Patent completed.*

284. M. SMITH. *Certain improvements in looms for weaving.* Dated January 31, 1863.

This invention consists—1, in the application of two chains of tappets working on the same barrel, or placed at the same side of the loom for working by a cross shaft, and the usual levers and rods, and the drop boxes at both sides of the loom. 2, in working the jacquard and the vibrator by the same lever, actuated by the second motion wheel or other convenient part of the loom. 3, in making the lower edge of the vibrator in line with the axis on which it vibrates, for the purpose of maintaining a uniform action on the warp, irrespective of the diameter of the warp beam. 4, in supporting the shaft for working the jacquard barrel in a lever, the fulcrum of which coincides with the pitch line of the wheels by which the barrel is driven, so as to be able to throw the barrel beyond reach of the needles, whereby the cards are kept in order and position when the loom is turned back; or the same object is accomplished when the jacquard is placed below by a pinion on the crank shaft driving a pinion on a side shaft, on which is a cam or scroll acting on a fixed pin. 5, in making the jacquard barrel with two or more rows of holes, and varying the level of the needles by a cam shaft or other equivalent, so as to bring them in line with any required row of holes. 6, in giving a positive motion to the taking-up roller by wheels and pinions driven by the crank or tappet shaft, and dispensing with the ratchet wheel now generally employed. By this means when the loom is turned back a similar motion is given to the taking-up roller. 7, in an improved weft stop motion, consisting of a thin blade of steel or other metal fitting between the dents of the reed, and sliding in brackets attached to the hard top and batten. This blade is raised at every pick by an incline attached to the breast beam or other convenient fixture, and in dropping between the warp threads which form the grid it feels for the weft; if the weft is absent the blade drops and acts on a lever connected to the stop rod for the purpose of stopping the loom. *Patent abandoned.*

285. J. LIGHTFOOT and F. TRACHSEL. *Improvements in the distillation of certain substances, and in apparatus employed therein.* Dated January 31, 1863.

This invention relates to a system of continuous distillation which is performed by this improved still, the construction of which is as follows:—The inventors take a strong tube, made of any suitable metal or material, and any convenient form or shape, which is provided with a main tap or valve at one extremity to admit and regulate the flow of steam within the tube; at its other extremity it is provided with a tap or valve to let out the condensed water and the surplus steam. This tube is placed in a slanting position, and they rivet, solder, or braze at the upper surface of the tube longitudinal slips of metal forming a trough or channel, and also sometimes transverse ridges or small bars, either metallic, glass, porcelain, or other suitable material, to increase the surface and retard the flow of the liquors passing upon them. The tube thus prepared is enclosed in a larger one, made of similar materials to the first; both ends of this outer tube or case are closed, and in order to let off the vapours of the substances distilled, they adapt at or near to the extremity of this outer tube a head or bent tube, similar to a swan's neck, which is joined or connected with proper worms, coolers, or condensers. At the upper end of the outer case they also place a smaller tube to deliver a stream or streams, jet or jets, or droppings of the matters undergoing distillation by the heat of the inner steam pipe. This smaller tube has a proper tap or valve to regulate the flow of these matters from the supplying vessel. At the lower extremity of the outer case they also place an outlet to pass off those matters which have undergone the operation of distilling, and which are left as residues. This outlet pipe may be put in communication with a worm or cooler, or may pass at once into a waste still or other convenient vessel. *Patent abandoned.*

286. T. BENNETT. *Improved arrangements for obtaining pictorial backgrounds, foregrounds, and perspectives, when taking photographic portraits or sun pictures.* Dated January 31, 1863.

In taking photographic portraits or pictures in which it is desired to adopt suitable backgrounds, foregrounds, or perspectives, it has been hitherto the practice to use a painted canvas descending to and terminating at the floor or standing-place of the apartment or place. Now, according to this invention, the patentee uses a canvas (or equivalent substance) suspended or secured upon a roller or rollers with pulleys and cords, by which the canvas can be raised or lowered. The said canvas (or its equivalent) is always of sufficient length to allow it to be brought down to the floor, then stretched along the same, and kept in position (if desired) by catches or grippers, so that the person or persons, or principal object or objects to be portrayed, may stand upon a part of the canvas or equivalent. The background, foreground, or perspective, which is to remain perpendicular, or nearly so, is to be painted or depicted in the ordinary or perspective manner, and that part of the canvas or equivalent which is to lay upon the floor is to be painted so as to have the same convenient effect as the upright part, and so as imperceptibly to "run into" the same; for which purpose he has hitherto adopted the plan of first painting the upright part and fitting the same to a corresponding position to that in which the same is intended to be used, and then stretching the horizontal part upon the floor, drawing lines or objects by the aid of camera. *Patent completed.*

287. J. GROSSMITH. *An improved mode of producing the aura-electric gas.* Dated January 31, 1863.

In the production of the aura-electric gas, the inventor claims the application of a new radiator by acting upon a solid, and the use of a radiating multiplied network forming shelves, by which he presents more surface for the air to act upon the volatile liquid than hitherto. He uses multiplied wire network for every one of the shelves, by which he presents both top and bottom surfaces for radiation. He claims the use of asbestos as the diffuser of the volatile liquid, by which he again presents surface at all angles of his cylinder. *Patent abandoned.*

288. F. TOLHAUSEN. *New or improved apparatus for cleaning the beams of mules and spinning frames, collecting the dust and waste thereof, and also for clearing the flooring.* Dated January 31, 1863.

The first part of this invention relates to a self-acting apparatus for cleaning the rollers, and also part of the rollers and beams of mules, self-actors, and other spinning frames. This object is accomplished by means of a brush, or block set with brushes or pencils standing out at different angles, so as to sweep the different parts to be cleaned. This brush is made to slide to and fro in a suitable guiding tube in front of and near the roller beam, and is set in motion from the front line of drawing rollers by means of double bevel-gear, drums, and endless mule banding. The reversing motion is obtained by a worm and wheel acting on catches and springs that actuate a lever, by which one or the other of the opposite followers of the bevel-gear is thrown into gear with the driving. The second part relates to collecting the wash delivered by the brush, and also wiping the top of the mule carriage when it runs in near the roller beam. This contrivance consists of a cloth of woolly texture, which is hung loosely under and near the roller beams, so as to receive the waste swept off by the self-acting brushes. The under or bulging side of this cloth also wipes the top of the mule carriage when it draws up under it. The third part of the invention relates to an apparatus for cleaning or dusting the flooring under the spinning frame, and which is traversed over by the carriage. This apparatus consists of a shaft mounted in suitable bearings in the mule carriage, and carrying by means of arms a rotary cleaning roller covered with flannel or other suitable material. This roller is let down so as to roll on the floor, and gather the waste thereon whilst the carriage is running out; and, when the carriage begins running in, the said roller is lifted off the floor, which is effected in a self-acting manner by means of stops and catches, and a click and ratchet motion lifting and holding up and releasing or lowering the roller arms at each end of the carriage path respectively, thus producing the desired effect. *Patent completed.*

289. W. DRUMMOND. *Improvements in apparatus for stopping the supply of gas to burners when the light is put out.* Dated January 31, 1863.

For the purposes of this invention a continued supply of gas is made to depend on the heat of the burner, or of part of the apparatus by which the supply of gas is governed, and such heat is caused to act on the valve of the instrument by which the supply of gas is allowed or prevented by means of expanding air, or it may be gas confined within a suitable chamber or space contiguous to the burner; or like arrangements may be made on the supply pipe contiguous to the main or on in any convenient position. It is preferred in all cases to employ an inverted cup or hollow vessel with its inverted edges dipping in quicksilver, so as to enclose a quantity of air, so that when the gas flowing through a burner has been lighted for a short time and the air expanded, the inverted vessel will be raised, and by its being raised will keep open the supply passage leading to the burner; but should the lighted gas be put out, the cooling of the air will allow the inverted vessel to descend, and thus close or be the cause of closing the supply passage. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated July 31, 1863.

1894. J. C. Haddan, of Bessborough-gardens, Pimlico, civil engineer. Improvements in firearms, and in artillery and projectiles for the same.

Dated August 6, 1863.

1938. J. G. Pinède, Liancourt, Oise, France. Improvements in apparatus for regulating the speed of steam and hydraulic engines.

1947. T. Simmelkiar, Black Rock, Cork, and J. I. Spicer, Park-road, Old Ford. An improved composition for coating or painting the bottoms of ships or vessels to prevent them from fouling.

Dated August 10, 1863.

1968. P. M. del Rio, Jermyn-street, St. James's, gentleman. A new machine for obtaining motive power.

Dated August 13, 1863.

2000. J. Edmunds, Birmingham, gunmaker. An improvement or improvements in gun and pistol furniture.

2004. M. A. F. Mennons, Abingdon Chambers, Westminster. Improvements in the construction of numbering machines. (A communication.)

2006. H. Brown, King-street, Cheapside, gentleman. Improvements in burners for lamps for burning oils or fluids.

Dated August 14, 1863.

2010. R. B. Greenwood, 416, Hackney-road. Improved means of preventing accidents upon railways.

2012. E. B. Wilson, 5, Parliament-street, Westminster, engineer. Improvements in blast furnaces.

2016. N. S. Russell, Great George-street, Westminster, civil engineer. Improvements in apparatus for working great guns.

2018. W. Asbury, Birmingham, engineer. Improvements in axles and axle boxes, and the parts of wheels immediately connected therewith.

Dated August 15, 1863.

2022. G. Davies, 1, Serle-street, Lincoln's-inn, civil engineer. Improvements in furnaces for heating, flattening, and annealing glass. (A communication.)

2024. R. Parker, Atherton, Lancaster, spindle and fly maker. Certain improvements in presser flyers to be employed in preparing, spinning, and doubling cotton and other fibrous materials.

2026. E. Lord, Todmorden, Yorkshire, machine maker. Certain improvements in machinery for preparing, spinning, and doubling cotton and other fibrous substances.

2028. J. E. F. Ludeke, 2, Elizabeth-terrace, Islington. Improvements in the means of keeping cameras or other apparatus steady when suspended to balloons.

2032. R. Lightbown, Over Darwen, Lancashire, manager. Improvements in looms for weaving.

2034. G. T. Bousfield, Loughborough Park, Brixton. Improvements in the manufacture of cement. (A communication.)

Dated August 17, 1863.

2036. J. Smith, Cheetham, Manchester, bleacher, dyer, and finisher. Improvements in machinery for finishing woven fabrics.

3040. W. Longbottom, Nelson Foundry, Barnsley, Yorkshire, machinist. An improved lubricator.

Dated August 18, 1863.

2046. J. Briggs, Blakely, Lancashire, engraver to calico printers. Certain improvements in coating or covering crinoline steel.

2048. H. Robinson, Skipton, Yorkshire. Improvements in lime kilns.

2052. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of hats, caps, and bonnets, and in apparatus connected therein. (A communication.)

2054. J. B. V. Faure. Improvements in pen and ink holders.

Dated August 19, 1863.

2058. C. Sonnhammer, Regent-street. An improved fan.

2060. T. Scott, Nelson-square, Surrey, engineer. Improvements in the construction of floating docks or apparatus for lifting ships and other bodies.

2062. S. Sanderson, High-street, Shoreditch, merchant. An improved fastening for leggings, stays, or other articles.

2064. R. H. Jackson, Olive Branch Works, Meadow-lane, Leeds, tool maker and machinist. Improvements in machinery for sawing wood and other fibrous substances.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, September 1, 1863.

966. J. Goucher. Steam boilers.

967. R. C. Clapham. Treating the waste liquors from bleaching powder stills in order to obtain hydrochloric cid and other products therefrom.

986. H. Rafter. Printing surfaces.

988. E. L. Simpson. Waterproof compounds.

991. J. W. Nottingham. Two-wheeled vehicles.

993. H. Donald. Bending or straightening metal plates.

996. W. Campion and G. Wilson. Machinery or apparatus employed in the manufacture of looped fabrics.

1005. J. Lee and E. Dawson. Looms for weaving.

1014. J. Cavanah. Cricket bats.

1016. W. N. Wilson and J. G. Grey. Machinery for sewing and stitching.

1028. C. Pooley. Certain parts of machinery for preparing and spinning cotton and other fibrous substances.

1034. J. Dunbar, jun., and J. W. Woodford. Apparatus for steering and manœuvring ships and vessels.

1036. A. Poirrier and C. Chappal. Blue and violet colouring matters, suitable for dyeing and printing.

1038. C. Beyer. Safety valves. (A communication.)

1039. I. Dimock. Machinery for cleaning, sorting according to size, and doubling silk and other threads.

1042. W. E. Newton. Thrashing machines. (A communication.)

1050. M. Valkenhuysen. A new castor for furniture.

1072. G. E. Donisthorpe. Apparatus used when getting coal and other minerals.

1085. H. W. Ripley. Apparatus for printing fibrous materials. (A communication.)

1086. M. Henry. Apparatus for manufacturing beton and artificial stone. (A communication.)

1092. C. P. Stewart and J. Kershaw. Engines, machinery, and apparatus for obtaining compressed air, and for applying the power thereof in propelling railway and other carriages.

1113. G. Haseltine. Springs for railway carriages and other purposes. (A communication.)

1124. W. Glover. Steering of ships and other vessels.

1130. S. Hibbert, J. Lawton, and J. Kay. Cleansing potatoes, and in decorticating the same and other esculent roots.

1133. G. Davies. Forging and dressing horse-shoe and other nails. (A communication.)

1146. C. A. Day, A. Lamb, and T. Summers. Marine engines.

1179. C. and W. Shorrock. Power looms for weaving.

1204. V. J. Cassaignes. Stereoscopes.

1239. J. Whitehead. Motive-power machinery.

1281. R. A. Brooman. Breech-loading ordnance and breech-loading and other small arms. (A communication.)

1425. W. E. Newton. Nozzles for hose and water discharge pipes. (A communication.)

1613. R. Mushet. Manufacture of iron and steel.

1760. J. Davison. Furnaces for boilers, smelting, and other useful purposes.

1778. H. Mége. Mode of treating fatty bodies.

1845. W. and J. Garforth. Preparing, beetling, or finishing textile fabrics, such as cotton, wool, linen, or other fibrous materials.

-2. S. Bury. Valves for steam engines.

1980. A. V. Newton. Process for hardening cast iron. (A communication.)

1986. G. Graham. Baths or boilers used in dyeing.

1987. R. Mushet. Cast steel.

1988. J. Cornforth and A. Andrews. Nails commonly called screw-rivets.

2034. G. T. Bousfield. Manufacture of cement. (A communication.)

2046. J. Briggs. Coating or covering crinoline steel.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 29, 1863.

577. O. Murrell.
580. A. F. Pagny.
581. G. Hawksley and T. Bissell.
584. C. Garton.
587. T. E. Symonds.
590. G. F. Lyster.
594. G. Price and W. Dawes.
601. J. Pollard.
602. C. M. Palmer and J. McIntyre.
603. J. F. Gits.
606. T. H. Morrell and J. Williamson.
607. E. A. Wünsch.
615. W. Whittle.
616. T., E., and R. Thornton.
622. W. Jackson and R. Watkins.
623. S. H. Foster, T. Bunney, and J. Anderson.
624. J. Miller.
627. J. Howie.
628. W. Clark.
629. J. Elsie.
632. W. H. Buckland.
634. A. Cuthell.
635. A. W. Makinson.
640. T. Hancock.
642. T. G. Webb.
646. R. Mushet.
647. J. Cowley.
648. H. A. Bonneville.
651. C. H. Lea.
652. W. Inglis.
656. J. R. Gorst.
657. W. E. Newton.
693. J. W. McCarter.
697. W. Young.
702. F. Hoyos.
706. T. Powell.
730. F. Norrington.
778. J. Leach and J. Anderson.
779. J. H. Warrall.
795. G. Davies.
805. W. Clark.
842. G. T. Bousfield.
885. J. N. Brown.
1048. J. J. Robert.
1058. H. Beare.
1180. C. L. Van Tenac.
1291. A. W. Hofmann.
1390. J. J. McComb.
1478. G. Davies.
1513. W. H. Dawes.
1594. J. L. Hughes.
1643. G. T. Bousfield.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2047. W. Thomson and F. Jenkin.
2062. G. T. Bousfield.
2063. G. T. Bousfield.
2068. J. Bingley.
2071. P. Effertz.
2074. C. W. Siemens.
2088. Sir P. Fairbairn.
2096. J. H. Johnson.
2100. W. S. Underhill.
2124. H. Moore and S. Newberry.
2128. T. Grimston.
2131. J. Hughes, W. Williams, and G. Leyshon.
2175. E. Horton.
2190. G. Wellman.
2475. J. Silvester.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2037. J. Apperly.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending August 29, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
70	0 4	124	0 4	135	0 10	148	0 4	159	0 4	170	0 6
73	0 8	125	0 4	136	0 4	149	0 4	161	0 4	171	0 4
75	0 8	126	1 0	137	0 8	150	0 6	162	0 4	172	0 4
101	1 2	127	0 6	138	0 4	151	0 4	163	0 4	173	1 2
114	2 10	128	0 8	139	1 10	152	0 8	164	0 8	174	0 4
118	0 10	129	0 4	140	0 8	153	0 10	165	0 4	175	0 4
119	1 8	130	0 6	143	0 4	154	0 6	166	0 4	176	1 0
120	1 4	131	0 8	144	0 4	156	0 8	167	0 8	177	0 8
121	0 10	132	0 10	146	0 4	157	0 4	168	0 4	179	0 4
122	1 4	133	0 10	147	0 4	158	0 4	169	0 4	180	0 4
123	0 10	134	1 4								

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

IRON:—

		£ s. d.		£ s. d.	p ct.
Welsh Bars, in London	per ton	6 15 0	to	7 0 0	2½
Nail Rods	do	7 10 0		0 0 0	
Hoops	do	8 10 0		9 0 0	
Sheets, single	do	9 10 0		10 0 0	
Staffordshire Bars	do	7 15 0		8 5 0	
Bars, in Wales	do	6 0 0		6 7 6	
Rails	do	6 5 0		6 10 0	nett
Foundry Pigs, at Glasg, No 1	do	2 13 6		2 18 0	
Swedish Bars	do	11 10 0		12 0 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		0 0 0	
Swedish Faggot	do	17 0 0		18 0 0	

COPPER:—

Sheet & Sheathing, & Bolts	do	102 0 0	0 0 0
Hammered Bottoms	do	112 0 0	0 0 0
Flat Bottoms, not Hamrd.	do	107 0 0	0 0 0
Tough Cake and Ingot	do	95 0 0	0 0 0
Tile Copper	do	89 0 0	0 0 0
Best Selected	do	98 0 0	0 0 0
Compositn. Sheathing Nails	per lb.	0 0 10	0 0 0
Yel. Metal Sheathing & Rods	do	0 0 8½	0 0 8¾
Fine Foreign	per ton	98 0 0	100 0 0
TIN:—			
English Block	per cwt.	5 15 0	0 0 0 2½
do Bar	do	5 16 0	0 0 0
do Refined	do	6 0 0	0 0 0
Banca	do	6 4 0	0 0 0
Straits	do	5 17 0	0 0 0
TIN PLATES:—			
Best Charcoal, I.C.	per box	1 8 6	1 9 0
Second Quality	do	1 7 0	1 7 6
Coke	do	1 3 0	1 4 0
LEAD:—			
Pig, English	per ton	20 10 0	21 5 0
„ Spanish Soft	do	19 17 6	19 10 0
Shot, Patent	do	23 10 0	0 0 0
Sheet	do	21 0 0	0 0 0
White	do	27 0 0	27 10 0

TIMBER, duty 1s. per load, drawback 1s.

Teak	load £12 0	£13 0		Archangel, yellow	£13 0	13 10
Quebec, red pine	3 10	4 10		St. Petersburgh, yel.	11 10	12 0
„ yellow pine	3 10	4 10		Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0		Memel	10 0	15 0
Quebec oak, white	5 10	6 10		Gothenburg, yellow	10 0	11 0
„ birch	3 10	4 10		„ white	9 0	29 10
„ elm	3 10	5 0		Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10		Soderhamn	9 10	10 10
„ fir	2 10	3 10		Christiania, per C., 12ft by 3 by 9 in.		
Memel fir	3 5	3 10		Christiania, yellow	21 0	23 0
Riga	3 0	3 5		DeckPlank, Dantzic, per 40 ft. 3 in.	0 14	1 1
Swedish	2 10	2 15		PUMICE STONE pr ton	6 10	9 0
Masts, Quebec red pine	5 0	6 0		OILS, &c.		
„ yellow pine	5 0	6 0		Seal, pale ...per tun	46 0	46 10
Lathwood, Dantzic, fm	5 10	6 10		Sperm body	80 0	10 0
„ St. Petersburg	8 0	8 10		Cod	55 0	55 10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				Whale, Sth Sea, pale	42 10	0 0
Quebec, white spruce	15 10	18 10		Olive, Gallipoli	60 0	0 0
St. John, white spruce	14 0	15 10		Cocoanut, Cochin	47 0	47 10
Yellow pine, per reduced C.				Palm, fine	35 10	36 0
Canada, 1st qual.	17 0	18 0		Linseed	41 0	0 0
„ 2nd do.	11 0	12 0		Rapeseed, Eng. pale	45 0	0 0
				Cottonseed	33 0	40 0

FRENCH & SMITH, Sworn Brokers, 4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number:— PAGE

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 11, 1863.

LOCOMOTIVE CONSTRUCTION.

NOTWITHSTANDING the dictum contained in Clark's "Railway Machinery," we cannot regard the link motion as otherwise than imperfect. Its comparative excellence we admit; but with the growing tendency for higher pressures and early cut-off, its defects become day by day more prominent. In order to maintain anything like a full pressure on a piston, moving at 800 or 1,000 ft. per minute—a speed frequently reached in express engines—it is essential that all passages leading to the cylinder should not only be short, direct, and of large area, but that they should be opened and closed with a velocity proportionate to the speed of the piston. Locomotives are seldom worked in the central notches, except when running fast. The travel of the valve is then shortened, and the ports not only reduced in area, but opened and closed with a tardiness, which greatly militates against the advantage to be derived from an early cut-off, diagrams taken at high speed showing a very remarkable loss of pressure as the piston pursues its course through the cylinder. Steam is estimated to flow into a vacuum with a velocity equal to that due to a body of the same density, falling through a space equal to the height of a column of steam of the given pressure. By this rule, steam of 120 lb. pressure would flow into a vacuum at about 2,079 ft. per second; but the difference between the velocities of any two pressures, is the velocity with which steam would flow into steam of a lower pressure. At the commencement of a stroke, or rather at the moment when the valve first opens, the pressure within the cylinder is comparatively trifling, steam then enters with great velocity; once, however, the difference in the densities of the steam in the boiler and that in cylinders ceases to be well defined, steam passes very sluggishly from the former to the latter, and is little able to overcome the resistance offered by long curved passages and the contracted areas of the steam ports. It is very unusual, in consequence, to maintain more than 70lb. in the cylinder at high speed, indicator diagrams falling at once on the commencement of the stroke, long before steam is really cut off. The analyzation of such diagrams is not easy, as it is impossible to tell, without setting out and measuring the valve gear, when the valve really closed. Theoretically, the ports should be extremely short, straight passages, opening directly from the valve-seat into the cylinder. The great size of the valve required to suit such an arrangement has hitherto precluded its adoption. Mr. Clark gives us good reason to believe that as much as 25-horse power is frequently expended in working valves as it is—a positive waste of power which it would be very injudicious to add to. If, however, the valves are properly balanced, there is nothing to prevent the employment of any size deemed most desirable; and if we are to adhere to the link and eccentrics, the sooner we have a large valve with a long throw, and great lap, the better. We illustrate this week a form of balance-valve, which, although recently patented here, has been worked for some time in America with considerable success. Plainmaison's slide-valves have been adopted on the Chemin de Fer du Nord since the year 1861 with excellent results, both in the Crampton express and Engerth goods engines. Railway companies don't like change, however; and the general introduction of the balance-valve is, here at least, apparently as far off as ever.

Quitting the subject of valves, and resuming the consideration of the means by which they are put in motion, we find existing arrangement, lauded for a simplicity which they do not really possess. The link motion, consisting as it does of two eccentrics with their rods, straps, pins, &c.; a link often built up of many pieces; and a rocking-shaft with balance weights or springs; is really the most complex part of the engine. Its expense is very considerable at first; and from the rapid wear to which it is exposed, and the nice adjustment which it must preserve, its maintenance forms a large item in the working expenses of the locomotive. We are well aware that this must be a distinguishing characteristic of any valve gear whatever; but we believe that other arrangements not a whit more complicated, will give better results. The mere fact of such a piece of machinery, delicate and finely wrought, answering its purpose so well, should rather encourage us in searching for a substitute which, not more simple, perhaps, would regulate the admission of steam to and its exit from the cylinders after a fashion approaching more nearly to theoretical excellence. Complexity is in itself no evidence of erroneous design. It only becomes reprehensible when it is introduced unnecessarily. In the construction of machinery, the end usually sanctifies the means; and there is no reason that a valve gear may not be very excellent, and very complex as well. In America, the use of the separate cut-off was long adhered to, and is even still held in high favour by many builders. At least one locomotive in the great Exhibition last year was so fitted, and it seems likely enough that its general adoption is not far distant. The variation in the lead, when the reversing lever is in different notches, is not the least objection to the link motion. The setting of valves is in consequence a positive science, and one understood or at least practised, only recently. A few years ago it was quite exceptional to meet with a locomotive which "beat" equally. Even yet there is great room for improvement on most of our great railway lines.

The question of balance weights, at one time considered definitively settled, seems likely to be re-opened. It is extremely doubtful that it is good practice to perfectly balance the reciprocating parts of a locomotive. One locomotive superintendent has removed three-eighths of the accurate counterpoise from his engines, with manifest advantage. The solution of the problem lies, we fancy, in the fact that the pressure on the piston does not accurately represent that on the crank-pin, when the engine is in motion, because it is modified more or less by the momentum of the piston, rod, and connecting rod—to such an extent, indeed, in some cases, that the strain on the crank-pin is much greater near the termination of a stroke than at its commencement, although the steam is early cut off. As the equilization of the impelling force on the crank-pin is extremely desirable, tending as it does to the steadiness of the entire machine, it is not improbable that a heavy cross-head, piston, and piston-rod may be better for high-speed locomotives cutting off very early, than those of a lighter construction. There can be no doubt, however, that the wheels must be accurately balanced, and this rule is seldom or never disputed. In conducting experiments on the subject, care must be taken to distinguish between the conditions under which an engine is tried in the shed, and those under which it performs its work on the road.

There is little tendency to alter the practice which deems a single pair of drivers sufficient for express engines. Locomotives intended for high speeds seldom or never are burdened with heavy trains, and with rails in good order they manage to proceed well enough, but, unfortunately, not without doing great mischief to the permanent way, in consequence of the excessive loads placed on the drivers to secure adhesion. Still there seems to be much weight in the arguments which are urged against coupling wheels over 7 ft. in diameter, which make 270 revolutions betimes in the minute. The momentum of an 8-ft. side-rod at such a pace would be something tremendous, and its fracture would lead to fearful results. For ordinary passenger trains there is no excuse for limiting the number of drivers to two; and coupled engines are rapidly getting into favour for this kind of work. For æsthetical as well as mechanical reasons, the second pair of driving-wheels should be placed behind the fire-box, not forward. If inside cylinders are adopted, the latter position throws all the work out of the horizontal line, and entails many difficulties with the smoke-box and framing. A few large engines of this class are doing good service on the North-Western, between Birmingham and Stafford. The driving-wheels are, we believe, 6 ft. in diameter, and hence the cylinders do not come inconveniently near the ground.

Steel tyres make their way rapidly into favour with locomotive superintendents, while the civil engineer regards them with unmitigated disgust, from their destructive effect on permanent way. Six or seven tons on a single wheel was, however, more than any iron tyre, possessing toughness enough to be safe, could bear without spreading; and to the employment of the hard irons which were resorted to as a remedy, may be attributed many of the accidents once so prevalent from the fracture of tyres. Railway companies have found it much to their advantage to purchase rails honestly made of good iron properly worked, instead of cheaper brands which proved utterly worthless. Steel tyres are not very injurious to such rails; still, a softer material is better for adhesion, cheaper to work, and perhaps safer, in some respects, than steel. If a tyre could be made one, with the wheel rim proper, there is no doubt that its durability would be considerably increased; not only would its resistance to spreading be greater, but the shocks and vibrations to which it is exposed would be transmitted to the entire mass of the wheel, instead of being more or less retained in the tyre. Under the present system, the tyre is exposed to a treatment nearly similar to that which it received in the rolling mill which gave it existence, the interior being nearly as much injured by the wheel rim, as the exterior is by the rail. Mr. G. S. Griggs, of the Boston and Providence Railroad, U.S., many years ago, set all his tyres on wood to avoid this action. The rims of the wheels are made with dovetailed recesses all round, running in the direction of the axle. Into these recesses hard wood-blocks, thoroughly dried, are firmly fixed, with the grain running in the direction of the groove. The tyres are then shrunk on, resting wholly on the wood, which stands, say, an eighth of an inch or less above the surface of the wheel rim. Mr. B. Adams has brought out a far more elegant arrangement here. He introduces a continuous hoop spring, fitting within an internal groove in the tyre, between it and the wheel. Two of these

hoops are, we believe, employed at present, each about one-third of an inch thick and 3½ in. wide. The wheel rim is turned slightly convex, and rests on the hoops, which of course surround it. Experiments conducted on the St. Helen's Railway, Lancashire, show that Staffordshire tyres, fitted to wheels on this system, have given first-rate results when put in competition with Krupp's steel, Swedish, and Hood and Cooper's best iron, fitted in the common way. Krupp's tyres have run 40,873 miles, Hood and Cooper's 20,798, Swedish 34,006, without requiring turning up, as an average mileage; while Staffordshire tyres, fitted on springs, have run 55,138 miles, remaining in excellent condition. The engines had all 4 ft. 6 in. wheels, except the last, which had 4 ft., and their weights varied from 19 tons 15 cwt. on Krupp's, to 20 tons 6 cwt. on Hood and Cooper's, 23 tons 14 cwt. on Swedish, and 21 tons on Mr. Adams' tyres. The saving to the rails must be considerable, for tyres can only be worn out at the expense of the rails. This same question of tyres nearly concerns the prosperity of railway companies. The maintenance of the permanent way is one of the heaviest items of expenditure which they have to encounter; and as the destroying element is found in the wheels of the locomotive, every improvement of which they are susceptible should be applied to them, without regard to the primary outlay, which is certain to repay itself a hundredfold.

THE VENTILATION OF ENGINE ROOMS.

The efficiency of the marine engine depends so much on the physical powers of the firemen, that it is rather singular that so little attention is paid to the means of rendering their toil endurable. In the factory or the mine, the supply of fresh air and a regulated temperature to the hands employed, is justly regarded as a matter of extreme importance; employers well knowing that money laid out to secure these desiderata, is always expended to advantage. The health of the operative is, according to recognized laws, well understood to tend powerfully to the master's prosperity. No man can work to advantage in a situation too hot or too cold; while a vitiated atmosphere goes a long way towards making the best hand worthless. Much, it is true, still remains to be done, through the length and breadth of the land, to enable our working population to participate in the benefits which some science and a little money, judiciously laid out, would enable them to enjoy. Still our workshops, as a rule, are roomy, and, in common with our mines, well ventilated; cool in summer and warm in winter. The moment we leave the land, however, we find in our steamships a marked exception to all this in stokeholes and engine-rooms so intensely heated, that it seems marvellous that man can endure such a temperature. Fresh air there is in plenty—the supply of the furnaces demands that; but the mere fact of a stokehole receiving ten or twelve thousand cubic feet of air per minute, is no argument that the temperature within it is not excessive, or that from such a cause alone it will or can be kept within reasonable limits. It is unfortunate that little or no attention has been devoted to a subject which is of considerable importance, not only as regards the health and comfort of bodies of men, who now really form the great bulk of the crews of our sea-going ships, but the durability and safety from fire of wooden vessels as well. Even in iron ships dangerous fires have ere now broken out from the intense heat of the boiler-rooms communicating either with inflammable cargo carelessly stowed, or with wooden decks improperly fitted. That the subject is encumbered with some difficulties we admit; but that in itself should have been a sufficient inducement to engineers and men of science to investigate the causes which lead to such a state of affairs, and suggest remedies either by practical examples or in their writings. Our scientific literature is almost silent on the subject, and our practice anything but what it should be. The lagging of boilers and the fitting of windsails, is considered to embrace everything essential—in fact, to leave nothing to be desired. And thus stokeholes are as hot now as they were in the first steamboats which crossed the Atlantic thirty years ago.

A steamer burning 50 tons of coal in twenty-four hours will require at least half a million cubic feet of air per hour for their combustion. The passage of such a great body of air at perhaps 60 deg., through a confined stokehole, would at first sight seem quite capable of keeping the temperature there within very reasonable limits. That it does do so to some extent is plain enough; if it did not, then no human being could endure the heat for ten minutes. That it does not do so in the fullest sense, is equally plain; and the reason is obvious. The heat within a stokehole is nearly all radiant. The ashpits, the smoke-box doors, the steam-pipes, the up-take—in short, nearly every portion of the boilers radiate more or less heat; and the incoming current of air cannot possibly prevent this dissipation of caloric, because heat will radiate in the teeth of the most powerful current of air we can command. A thermometer, usually hung in some situation where it is more or less protected, gives no idea whatever of the actual state of affairs. On the level of the floor-plates, at a short distance in front of the boilers, a thermometer placed in the full glare from the ashpits, will indicate, if protected at the back from the current of air, a temperature which will rather surprise those who try the experiment for the first time. Under the deck beams, over the boiler, and in out-of-the-way corners, the mercury will stand very much lower, while just under the ventilators or windsails it may not indicate 60 deg. It is difficult to find any situation other than a stokehole, where so many different temperatures may exist within a few feet of each other. Now we do not pretend to assert that any possible contrivance which can come into practical use on ship-board, can render boiler-rooms really—not comparatively—cool; but we believe that they might be rendered a great deal cooler than they are now by proper arrangements. The first consideration must be the prevention of radiation; the next, the diffusion of the entering air, so that every portion of the stokehole may have its due share.

The greater proportion by far of the radiated heat proceeds from the ashpits, the inclination of the grates aiding materially to this. Many well-constructed boilers are fitted with ashpit dampers. If these are all closed, as well as the fire-doors—although really very little air now passes through the stokehole—it will, however hot previously, become at once endurable. The converse of this experiment is found in throwing open the fire-doors and ashpit-dampers simultaneously; no amount of air can then render or maintain the temperature other than excessive to a degree. Yet, in the latter case, there is no doubt that ten or twenty times the quantity of air passes through the ventilators that did in the preceding experiment. This is tolerably conclusive evidence that the introduction of a great body of air can never accomplish the end in view, unless aided by other expedients.

The locomotive engine-driver is never exposed to any considerable temperature so long as the fire-door is shut, solely because iron plates at 300 deg. or 350 deg. radiate little heat; but were the ashpit mouth placed on the foot-plate, the case would be far different. It is not impossible that, ere many years pass away, boilers of the locomotive type will find their way into general use in our marine; indeed, such boilers have been employed before now with very good results. In such a case, it might not be difficult to fit one entrance to the ashpit under the barrel of the boiler, and away from the stoker, while a door might be provided beneath the fire-door, through which the ashes could be removed. These boilers would have fire-boxes resembling, more or less, that of the locomotive. The grates would be distinguished for breadth rather than length, and, as a consequence, the labour of the stoker would be very much reduced. Small fire-doors could then be employed, through which little heat would radiate when opened, especially if they were placed high over the grate, a clinker door beneath, rarely opened, serving to clean the fires. All this, however, is to a certain extent prophetical, and so far not practical. Much may be accomplished with the existing boiler; and to it the engineer who really wishes to ameliorate the stoker's condition, will naturally turn his attention. Nothing is easier than to fit a sheet-iron curved casing in front of the boilers, made in sections, and hinged to each dead plate just under the fire-door, reaching from thence to the floor-plates; this casing would form a continuous and roomy wind-trunk, supplied at each end with air from the down trunks of two or more large sheet-iron windsails. Any section could be raised with ease on its hinges, to clear the space beneath the fires. It would be quite unnecessary that the joints should be air-tight, the casing being intended merely as means of protecting the stokers from the radiant heat of the ashpits. Dampers in the wind-trunks would regulate the fires to perfection, and the entire arrangement would be simple, removed in a moment if occasion required; and taking up very little room, would really not at all interfere with the proceedings of the stokers, once they became accustomed to it.

In the smoke-box doors we have another source of radiant heat, which, if less powerful than the ash-pits compensates for that circumstance by offering an immense surface. So long as flame is suffered to exist in the up-take, it is ridiculous to expect these doors to remain cool. The 3-in. tubes of a marine boiler are, if short, easily traversed by flame when the furnaces have a good draught; and, as a consequence, it is not unusual to see smoke-box doors hot enough to glow in the dark now and then, if the fires are urged a little. The guard-plates put within them on studs are seldom or never sufficient to prevent the transmission of a great quantity of heat to the stokehole; and fire-clay linings, which have been tried before now, are heavy and troublesome. A better plan is to provide a false door outside, which can be easily fitted in such a manner that a constant current of cool air will pass between it and the real door into the funnel casing. The importance of lagging boilers thoroughly is too well understood now to require comment.

However carefully the radiation of heat is prevented, no stokehole can be cool unless the distribution of the air entering to supply the fires is carefully attended to. The best arrangement for the boilers is that which places them at the sides of the ship, with the furnace doors

opening on a central passage running fore and aft. In deep ships, the deck immediately above the stokehole should consist of a grating running its entire length. This is often omitted, the air being introduced through windsails frequently reaching nearly to the floor-plates. Such arrangements occasionally increase the draught, but they add materially to the temperature to which the stoker is exposed, and are objectionable in consequence. Single-decked ships are fitted sometimes with a grating of considerable size, just above the firing place; in other cases, merely with one or two large apertures; the entering air then descends straight to the fires. A man standing directly in the current may possibly find it cool enough, while along the sides of the ship the temperature is fearful. The best results are obtained by combining windsails, having trunks reaching far down beneath the deck, with very large open gratings. The fresh air descends freely, unopposed by the heated atmosphere which ascends through the gratings. The descending trunks can easily be arranged to distribute the air equally to every part of the stokehole, thereby materially aiding the draught. In the Navy, the plan of using lattice bulkheads between the engine-room and the rest of the ship has been lately introduced with manifest advantage. It is obvious that this scheme secures the diffusion of the air in the best possible manner. Its introduction in bulk is always to be avoided on principle, and its admission through numerous apertures can easily be secured in practice. The general ventilation of ships should receive far more attention than it does; and both the engineer and the naval architect will find the subject fraught with interest, tending as it does to the health of the crew, the comfort of passengers, the durability of the ship, and the good condition of cargo.

THE BRITISH ADMIRALTY.*

We lately directed the attention of our readers to what we consider an interesting comparison between the English and French Navies. In the course of our critique on Mr. X. Raymond's book, we mentioned that the most striking part of the work is the exposure of our incapable Naval Administration. Now M. Raymond is no jealous-eyed critic. He is not bitten with Anglophobia. He is neither burning to avenge Trafalgar and Waterloo, nor penetrated with the mission of sweeping our flag from the seas. Quite the contrary. It is true that his pride in the success and rapid progress of the French Navy during the last fifty years makes him inclined to annex rather too much honour to his own country; but his sympathy with English self-help, self-government, and free-trade makes him, on the whole, as fair and candid towards England as could be expected. It is with no malignant spirit that he points out the defects—too well known in our own country—of our Naval Administration. It is as a friend to England, and as a partizan of the Anglo-French alliance, that he points out the shortsightedness and inefficiency of the Board of Admiralty. He is one of those "who believe that the maintenance of good relations between France and England is a duty of the two countries—is a benefit for the whole human race. . . The continual failures of the Admiralty are much to be regretted by the French themselves, as they indirectly cause distrust against France, which mars a good understanding between the two countries. It is not in human nature to voluntarily confess its faults; and when the Admiralty meets with some fresh mishap, when it sees itself manifestly left behind in the race for superiority in the adoption of any new invention, the Board at once employs a certain proceeding—as yet always successful—which is certainly not calculated to keep up a reciprocal sympathy between the two nations. This proceeding is the greatest proof of cleverness the Board has yet given, but it is a proof of a hateful cleverness. Instead of confessing its faults with some approach to honesty, the Admiralty raises a great outcry against French ambition; it accuses us of plots and plans of invasion—accusations which nothing bears out; it stirs up the spirit of the nation against us; and in the meantime the Board obtains hundreds of millions of francs to make up for past errors." . . The injury done by the mismanagement of our Naval Administration does not end in England. This management, with its perennial crop of blunders, gives rise to a dangerous misunderstanding in France itself. Ill-informed people amongst the French — judging England by what they see at home—fancy that the Admiralty is the true representative of England's power; they do not perceive that the Admiralty, as constituted at present, "is but a detail, a fraction of the budget, a first stake in the game," is but the vanguard of England's naval power; and drawing conclusions from circumstances they do not understand, they indulge in the most extravagant fancies. "Would it not be better for us French if the Admiralty never fell into such a ridiculous and dangerous position?"

Such is the spirit that has inspired Mr. Raymond's severe remarks upon the constitution of the Board of Admiralty. Most Englishmen would feel in a like way; but the recollection of the enormous sums already wasted through mismanagement of the estimates, frequently doubling the total amount of the French maritime budget with less material produce in ships, would give additional intensity to an expression of feeling by any unfortunate ratepayer.

A great weakness in the present constitution of the Admiralty consists in the fact that no single member is responsible for the collective acts of the Board. The First Lord is only nominally responsible, as the presence of three members is required to form a legal decision upon any important matter. Again, the First Lord is, as a rule, merely a political personage; is totally ignorant of maritime affairs; and his proposals can be at any time overwhelmed under a deluge of technical objections from the four professional members of the Board. Both the executive and deliberative powers are thus virtually vested in the hands of the four professional members of the Board. What is the result? As M. Raymond asks: —"Do you know four doctors agreeing on the best way of treating a malady—four theologians agreeing on a question of philosophy—four engineers, on the best means of, say, getting rid of the sewerage of London? Then why expect four ship-captains to agree in a question of discipline—of administration—of sanitary arrangements—of armament—of construction?" The sitting is raised; the question is shelved; and subaltern routine continues to royally spend the money of the public. At last, the Board wakes up some fine morning to find that the Navy "must be reconstructed," or that hasty, and therefore most expensive efforts must be made to catch up the advance gained by other nations. Frederick the Great used to say that "there is something worse for an army than a bad general, and that is—two good generals." But the hexarchy of the Admiralty Board is not always composed of good generals, or rather of good seamen. Chosen for political seasons, and subject to the vacillation of party warfare, the average existence of Admiralty Boards seldom exceeds two years; and thus, of the two estimates for which the Board ought to be responsible, one is perhaps already half-spent when the existing Board arrives at this helm, and the second estimate has to be accounted for by the succeeding administration.

The eccentric character of the Board does not confine itself to its constitution, but also extends to its composition. Of the six Lords of the Admiralty, two are Members of Parliament professionally unconnected with the Navy, and the other four are exclusively and simply captains of men-of-war. Not one of the other important specialities composing the naval establishment of a nation is represented at the Board. The four naval commanders are in the majority, and are the actual "masters of the situation." The other branches of maritime affairs—such as hydraulic works, shipbuilding, ordnance, sanitary and other matters—are, one and all, utterly unrepresented at the Board. As is well known, powerful causes of jealousy always exist, in all countries, between the builders of ships and the sailors of ships. In England, the sailors and fighting men have been allowed to utterly suppress their civilian adversaries. The management of the shipbuilding department, is, was, and perhaps always will be completely in the hands of sailors; and Sir Robert Sepping, Sir William Symonds, Sir Baldwin Walker, and Admiral Robinson were successively chosen from the class of ship-captains.

Again we ask, what are the results of the system? In mere quantity, the work turned out by the Admiralty Board during the last fifty years, is less than the amount done by the French Naval Administration, with half the expense. The results in *matériel*, viz., ships, hydraulic and other works, are quite out of proportion to the relative amounts of the French and English naval budgets. In quality, the work performed is far behind that of the French—who have beaten us in the race of progress towards improved means of attack and defence; who have forced us twice to reconstruct our Navy; who have forced us to improve our artillery; who have thus successfully encountered us in what we vainly imagined was our own ground—the application of steam and of iron to naval construction and warfare. "The foresight of the Admiralty is continually at a loss; and it does not even know what is going on in its immediate neighbourhood." The life of the Admiralty seems to be passed in a deep and peaceful slumber, only occasionally disturbed by intermittent and sudden rousings by the House of Commons. At the end of every seventh year, the Sleeping Beauty of Somerset House is subject to a short period of wakeful and even feverish anxiety, to again subside into the enchanted seven years' sleep. In 1851, the House had to force the Admiralty to give up sailing vessels—seven years after they were abandoned by the French for war purposes. Four years after the French had given up auxiliary steamships, the Admiralty—suddenly perceiving that France had more auxiliary steamships than England—determined to "rebuild the fleet." The time was well chosen. All the world knew, except the Admiralty, that the French had not built a steam-vessel since 1855. Any one, except the Admiralty, could, during a whole year previous to 1859, have seen the "Gloire" in the docks of Toulon. Another seven years' period passes away; another Naval Administration battle is fought and won in the House of Commons, and the Board unwillingly [illegible] wooden s[illegible]

* Les Marines de la France et de l'Angleterre. Par Xavier Raymond. Paris and London: Hachette, 1863.

As M. Raymond says:—"If this is not improvidence and carelessness, no such qualities exist on earth." As to order in money matters of naval officialdom, we all remember how Lord Clarence Paget, in 1859, showed that a million sterling is annually engulphed in the hands of the Admiralty—no one knows how, and no one can account for its disappearance. As to the order and discipline amongst our seamen, we all too well remember the late disgraceful mutinies in the "Princess Royal," the "Liffey," and the "Marlborough." The happy audacity of Lord Clarence Paget is now enlisted in the service of the present Admiralty; the reformer out of office is now a Conservative official. The usual septennial slumber of the Board elapses in 1868. Supposing that in that year we are still blessed with Lord Clarence Paget in his present position, or even supposing that another special pleader be retained for the defence of the Admiralty, what would we not give to know the fresh seven years' blunder that will have to be excused and made good by the millions of the nation!

AERIAL NAVIGATION.*

WHILE M. Nadar is preparing to try an experiment which I venture to say is quite certain to be a failure, I propose to take advantage of public attention being attracted to the subject by his doings to invite some consideration of the principles which bear on the matter, and to endeavour to show that, while the air can never be navigated by means of a mere balloon, however big, we may, nevertheless, begin to navigate it as soon as ever we choose.

"If any new triumph of science could astonish us in these days," says Vespertilio, "it would be the success, however imperfect, of any attempt to navigate the air." After discussing the matter through nearly two columns of the *Times*, he came to the conclusion that "the problem of aërial navigation will be easily solved whenever the progress of science shall place us in command of a motive power considerably lighter, in proportion to its capacities, than the steam-engine, *and not till then*." As by far the larger number of all who have of late years given attention to this subject have come to precisely the same conclusion, to call it in question may augur some audacity; but I believe it may be readily shown that this conclusion is fallacious, and that we have *already* at our disposal the means of at least partially solving the problem to which it refers—of solving it, that is to say, *as far as it ever will or can be solved, except in relation to the question of speed.*

It should be clearly understood, at the outset, that balloons do not solve it. "Balloons," wrote Vespertilio, "do not navigate the air—they only float on it in utter helplessness." We are all familiar enough with the sight of these machines moving majestically over our fields and cities. A balloon ascent forms part of the programme of almost every popular out-door *fete;* and when the balloon retouches the earth it is always at some distance from the spot from which it ascended. The horizontal motion which it thus performs, however, is motion only in relation to the earth; except in ascending or descending, a balloon never moves in relation to the atmosphere. It may travel over land or sea, for hours together, at the rate of scores of miles an hour; but, unless it shall have varied its *elevation* during the voyage, it will occupy precisely the same place in the atmosphere, and be surrounded by the same identical particles of air, at the conclusion as at the commencement of its journey. An aëronaut, seated in the car of a balloon, may vary at will, within certain limits, the degree in which he and the machine which buoys him are elevated above the earth. He may at pleasure, under certain conditions and within the limits alluded to, either rise into higher or descend into lower regions of the aërial ocean in which he is suspended; but in this power to ascend or descend lies his only control over other the direction or the length of his aërial journey,—and he can have no control at all over its speed. His only horizontal motion must be in the direction of the current he is in, and his rate of motion cannot in the least differ from its rate. He can move neither against the current, nor across the current; and in the direction of the current he can only move just as fast as it moves. He cannot move either faster or slower, not even to the extent of an inch a day. At present, therefore, balloons, as regarded as a means of conveying passengers or merchandise from place to place, have no practical value whatever. They have been made useful in military reconnoitering, and Mr. Glaisher has made them serve the interests of meteorological science; but they have *not* yet been made to navigate the air. And it is not too much to say that they never can be made to navigate it. Even if, by some inconceivable means, the power of an engine could be applied directly to a balloon, so that the centre of effort would be rendered coincident with the balloon's centre of gravity, the balloon could be made to go through a few wild gyrations; but, owing to its globular shape, its propulsion in any steady straighforward, horizontal course would still be impossible. It is useless, therefore, to dream that the air can ever be navigated by means of balloons. Balloons will never be able to do more than just carry a few passengers, or a few light loads of merchandise, in the direction, and at the speed, of whatever current may chance to be prevailing at the place and at the time at which the experiment is made.

Seeing the utter hopelessness of the idea of navigating the air by means of balloons, Vespertilio, as so many others have done, came to the conclusion that if men are ever to accomplish aërial navigation it must be by means of machinery constructed upon the model of the wings and attendant apparatus of "flying animals." Vespertilio's favourite "flying animal" is the bat—hence his choice of a signature; but as there is little essential difference between the principles which govern the flight of bats and those upon which the flight of birds is effected, and as birds are by far the pleasanter things of the two to write about, the latter are the only "flying animals" that will here be further spoken of. In Dr. Carpenter's "Animal Physiology," the means by which they raise themselves into the atmosphere, and sustain themselves in it, are thus described: "The action of their wings is such that the air is struck with less force during the up-stroke than during the down-stroke; otherwise, the effect of the former would neutralize that of the latter. This is accomplished partly by the greater velocity of the down-stroke, as compared with the up-stroke, which causes the resistance of the air to be much greater in the former than in the latter. But it is by the alteration of the surface of the wing, as it acts upon the air, that the chief difference is made; the arrangement of the great feathers being such that they strike the air with their flat sides, but present only their edges in rising." Now, it has usually been supposed that almost the only difficulty in the way of the successful imitation of the flight of birds consists in the circumstance that the latter are able to move their wings with an immensely greater force than—considered weight for weight and bulk for bulk—either a man or a steam-engine is capable of exerting. The Vespertilios have assumed that a man could navigate the air by means of a machine provided with artificial wings, if he could work these wings with a degree of force corresponding with that with which a bird works its wings; and hence they have been constantly crying out that a source of motive power sufficiently lighter than the steam-engine is all that they want in order to enable them to fly. I shall show below that this notion is an utterly mistaken one; but, assuming for the moment, that it is sound, let us inquire *how much* lighter than the steam-engine the motive power must be which would be requisite to enable a machine to raise itself into, sustain itself in, and propel itself through the atmosphere, by means of artificial wings. This is a branch of the subject which the Vespertilios have never gone into, notwithstanding that the calculations may be very readily made. It is known, to begin with, that "the swallow, *when simply sustaining itself in the atmosphere*, is obliged to use as much force, *merely to prevent its fall*, as would raise its own weight twenty-six feet in a second." In estimating the "horse-power" of steam-engines, the measure of the power of one horse is considered to be the ability to raise 33,000 lb. to the height of one foot in a minute. As 33,000 lb. are equal to about 14¾ tons, it will come to the same thing, if, instead of regarding one horse-power as the ability to lift 14¾ tons one foot per minute, we regard it as the ability to lift one ton 14¾ feet per minute. Twenty-six feet in a second is at the rate of 1,560 feet in a minute, and 14¾ into 1,560 goes very nearly 108 times. Consequently, to simply sustain in the atmosphere a machine constructed upon the model of the swallow, and weighing, with all its cargo, just one ton, would require the exertion of a force equal to that of a steam-engine of 108-horse power, even supposing that this machine were *an exact reproduction* of its model, as regards its form and the relative size, weight, and strength of all its parts, and that it were as *perfectly constructed* as the wonderful living organism it was designed to imitate. It is quite clear, however—to take the latter point first—that it could not be thus perfectly constructed. Let it be constructed only one-fourth as perfectly—if one may use such an expression with refernnce to a degree of perfection which is infinite of its kind—and it would be by far the most marvellous piece of mechanism that human skill ever contrived. This at once raises the required force to 432-horse power; and even that would not be enough, inasmuch as the *design* of the model could not be imitated any more successfully than its construction. The artificial wings, for instance, could only be moved by means of "levers of the second kind"—a kind of lever, of which a butcher's "steelyard" affords the commonest example. Owing to the aërial machine having to be constructed of some material much heavier, in proportion to its bulk, than the bodies of birds are, while the superficial extent of the wings would have to be proportionate to the weight rather than to the bulk of the machine, the short arms of these levers would be obliged to be much shorter, in proportion to the length of the long arms, than is the case with the levers which move the wings of birds. As whatever power was applied to the artificial wings would have to be applied to the ends of the short arms of the levers in question, it would thus act at an enormous disadvantage, and that disadvantage would be very greatly increased by the impossibility of imitating to more than a very limited extent the beautiful arrangements which cause the wing of a bird to experience much less resistance when moving upwards than when moving downwards. It is not merely, as quoted above, that "the arrangement of the large feathers is such that they strike the air with their flat sides, but present their edges in rising," but *all* the feathers "are so placed with reference to each other that in the upward stroke they tend to separate and allow the air to pass between them, while in the downward stroke they are pressed against each other so as to present to the air an impervious expanse, and thus to secure the greatest possible amount of atmospheric resistance." At the best, this arrangement could be imitated but very imperfectly, while the *elasticity* of the wing of the swallow could not be imitated at all in any artificial wings large enough and strong enough to enable them to sustain the amount of atmospheric resistance which they must be able to sustain in order to lift and support a ton. Such wings must necessarily be rigid; and moreover, must be very much heavier, in proportion to their size, than the wings of birds. It is certainly under the mark to say that all these disadvantages, acting together, would render it impossible for any artificial wings to be moved with force enough to enable them to support a ton in the atmosphere, except by a force at least four times greater than would have been sufficient for this purpose could the wings and the apparatus for the application of power to them have been accurate imitations of those of the swallow, differing from these only in being superior in size and inferior in excellence of construction. A winged chariot, weighing, with its contents, only one ton, would thus require a force equal to the power of 1,7[illegible] horses simply to sustain it in the atmosphere, after it had been raised thereinto by the exertion of a still greater force, and without propelling it an inch in any direction. Making allowance for the additional force necessary, first to raise it into the atmosphere, and afterwards to propel it while sustained therein, 2,000 horse-power may certainly be said to be the very least that would enable a machine weighing a ton to navigate the air by means of artificial wings. Supposing, therefore, that there were no other ground of objection to the artificial wing idea than this, before it can be carried into practice some engine must be invented which shall be so light that, with all the requisite appliances—including the wings, whatever food the engine may require, and the "car," or other receptacle for passengers and cargo—it shall not weigh more than one ton for every 2,000 horse-power it can as[illegible] The wings, indeed, would necessarily be of [illegible] great weight that for each ton which engine [illegible] and wings together might weigh, probably not [illegible] than a quarter of a ton would be available f[illegible] engine—and even this allows nothing for t[illegible] sengers and cargo. I believe that no steam [illegible] of 2,000 horse-power has yet been con[illegible] which, with its boilers, the water in them [illegible] hour's consumption of coal, and water [illegible] replenish the boilers during twelve hou[illegible] would not weigh at least 300 tons, or m[illegible] thousand times the weight of an engine li[illegible]

* "Weldon's Register of the Arts and Sciences."

to "solve the problem of aërial navigation" on Vespertilio's plan, even were a sufficiently light engine all that is required to do that. Improvements conducive to lightness are constantly being made in steam-engines; and other sources of motive power are being discovered, and will, doubtless, be rendered practically available in time. But if men are not to navigate the air until they can construct an engine which, while weighing only a quarter of a ton, shall be able to put forth as much force as the paddle-engines of the "Great Eastern" can exert, the air will *not* be navigated until long after the present generation shall have been gathered to its fathers.

The exceeding lightness requisite in the engine which must move them, is not, however, the only obstacle to the navigation of the air by means of artificial wings. There is, as hinted above, another difficulty in the way, and one which would render such navigation impracticable, on any extensive scale, even if we had engines of 2,000 horse-power weighing, not even a quarter of a ton, but, suppose we say, only a quarter of an *ounce*. It consists simply in the circumstance that for an aërial machine sustained by the motion of wings to be able to support a ton, including its own weight, the wings of the machine must be of such enormous size, that—so far, at least, as we at present known—there is no substance in nature strong enough to make levers with which to move them. Even, therefore, if we had an engine which, while capable of putting forth any required amount of force, should weigh absolutely nothing at all, the transport of passengers or merchandise by means of artificial wings would still be as impossible as it is at present.

And yet man may navigate the air if he will, and as soon as he will. To the question—"If by means neither of balloons nor of artificial wings, then by *what* means?"—I reply: by imitating, not the Birds, but the Fishes.

The birds and the fishes constitute the only examples we have in nature of animals being able to sustain themselves in, and at the same time to propel themselves through, an element lighter than the heaviest portions of their own bodies. We have seen by what means the birds do this, and that we cannot imitate them. In the case of the fishes, the matter is managed in another way. Unlike the bird in flying, the fish in swimming has no weight to bear, and so all the exertion it needs to put forth is for the purpose of propelling itself. The greater portion of its flesh and bones is of as nearly as possible the same specific gravity as the element which it inhabits, and the excess of weight of the heavier portions is balanced by means of a long narrow bag filled with some gaseous body by many more times lighter than water than hydrogen is lighter than atmospheric air. As a whole, the body of the fish is rendered of exactly the same weight as the quantity of water which it displaces, and it is, therefore, sustained in the water just as a balloon is sustained in the atmosphere; and this, too, at least to some extent, by exactly parallel means. For man to navigate the air, the machine by which he does so must have thus much in common with the balloon—it must be as self-buoyant in the element it has to travel as the fish is in *its* element. Therefore, although balloons cannot accomplish the navigation of the air, it can be effected only by the aid of those light gases by means of which balloons are rendered buoyant. The object in view can only be achieved by some method of applying the lifting power of the light gases more advantageously than this is done in the case of balloons. That method can only consist in an alteration of the *form* of the receptacles containing the gas. Instead of being spheroidal, they must be more or less fish-shaped; *they must be flattened cylinders with paraboidal ends.*

In order to show clearly, by a readily intelligible illustration, what influence this simple change of form would have, let us suppose a hundred balloons, all of exactly the same size, to be ranged in a row, like the carriages of a railway train, and let the hundred balloons be all connected with, and all assist to support, one long, narrow car. Such a train of balloons would represent the proposed cylinder sufficiently nearly—especially as the "cylinder" would itself virtually consist of a number of distinct bags of gas connected together, the chief difference between it and the train of balloons being that in it space would be economized, and steadiness of lifting power and uniformity of motion secured, by there being no such interstices between the bags of gas composing it as there would be in the case of the train of balloons. It is obvious that, to the motion through it, end-foremost, of the supposed train of balloons, the atmosphere would be able* to oppose only the same amount of resistance as it would oppose to the motion through it of any one of the balloons singly. No more force, therefore, would be required to propel the train of balloons than would be required to propel a single balloon, but the train would be able to lift an engine for the supply of that force a hundred times heavier than the single balloon could lift. As the power of an engine increases much more rapidly than its weight, there could thus be applied to the propulsion of the train of balloons several hundred times more force than could be applied to the propulsion of any one of them by itself.

I have said that the aërial cylinder which this article is written to suggest would consist, in effect, of a combination of a number of separate bags of gas. It would never do to make it consist simply of one huge long narrow bag; because such a bag, if filled with a light gas and allowed to rise in the atmosphere, instead of floating horizontally, as the cylinder must, in order to be available as a means of navigating the air, would float with its longest axis vertical to the earth's surface. To prevent its doing that, the cylinder, when not actually composed of a number of distinct bags combined together, should be divided into a number of separate compartments or cells, each of which should be higher than it was wide—should be longer, that is to say, in the direction perpendicular to the longest axis of the cylinder as a whole than in the other direction. It will readily be seen that by this simple arrangement it would be secured that it should be impossible for the cylinder to float in any other way than horizontally.

That such a cylinder could be propelled, and by such means for the supply of motive force as we have already at our command, is not a merely speculative opinion—an enthusiastic conviction, which may or may not be well founded. It rests on data which have long been established, and have been tested by actual experience thousands of times. It is based on the following established facts:—

1. The weight of a cubic foot of hydrogen is 36·5 grains, and that of a cubic foot of atmospheric air 523 grains. A cubic foot of hydrogen will, therefore, sustain in the atmosphere a heavy body weighing 486·5 grains, being the difference between its own weight and that of the volume of air which it displaces. There are 7,000 grains to the pound avoirdupois, and 14·5 times 486·5 is 7,054·25. Consequently, 14½ cubic feet of hydrogen will sustain a pound and 54·25 grains.

2. A body moving through the atmosphere at the rate of one mile an hour, and presenting a flat surface for the atmosphere to act upon in opposing its motion, experiences a resistance of ·005 of a pound on every square foot of such surface, and this resistance increases as the square of the velocity.

3. "This resistance to motion through the atmosphere is greatly modified by the form of the moving body. The form that gives least resistance is nearly that of a parabola, or a form somewhat resembling the breast of a duck or the head of a fish. The body should also taper backwards, like the body of a fish." The resistance to a paraboloid is one-third less than the resistance to a plane suface equal in extent to a section of a paraboloidal body, taken at its widest part.

From these data, both the lifting power of a cylinder of any given dimensions, and the resistance which the atmosphere would oppose to its motion, at any given speed, can be readily calculated.

Let us suppose, then, a cylinder of the kind indicated, to be 60 ft. long, and to average 12 ft. high and 8 ft. wide. Such a cylinder would contain 5,760 cubic feet, and the lifting power of that quantity of hydrogen would be 400 lb. Supposing the silk, and whatever apparatus the cylinder was furnished with, to weigh 260 lb.—in reality it need not weigh nearly so much—there would still remain a lifting power sufficient to lift and sustain a man weighing ten stones. A man of ordinary strength is able to lift 6,000 lb. to the height of 1 ft. in a minute, when applying his strength under fair mechanical advantages. Five miles an hour is 440 ft. in a minute, and 440 into 6,000 goes 13⅓ times; so that the strength of one man, applied under proper conditions, would be sufficient to lift 13⅓ lb. 440 ft. in a minute. A plane surface, moving through the air at the rate of 440 ft. in a minute, or five miles an hour, would experience a resistance of twenty-five times ·005, or ·125, of a pound on every square foot; and if the plane surface were equal in extent to the largest section of the proposed cylinder, it would thus experience a total resistance of 14 lb. In the case of the cylinder itself, owing to the paraboloidal form of its ends, the resistance would be a third less than this, reducing the total to 9⅓ lb. To propel this cylinder at the rate of five miles an hour would, therefore, require the exertion of a force capable of lifting 9⅓ lb. 440 ft. in a minute. We have seen that a man of ordinary strength could lift 13⅓ pounds 440 ft. in a minute. Consequently, he could propel the cylinder, at the speed mentioned, with great ease.

I venture, therefore, to repeat that we have *already* at our disposal the means of navigating the air.

WALTER WELDON.

* That is, except in so far as the circumstance of the side of the train of balloons presenting, not a uniform flat surface, but a series of bulging projections, might increase the hold of the atmosphere. In the case of a cylinder of the kind suggested in the above article, holding a hundred times as much gas as a balloon whose *side* should present just the same amount of surface as either *end* of the cylinder, the case would be *exactly* as stated in the text.

THE "ROYAL SOVEREIGN."

THE "Royal Sovereign's" turret "machinery," with the bed upon which it rests, we will now endeavour to describe, premising that the diameter of the turret is less than that of the turn-table or the machinery upon which the turret revolves. Level with the ship's lower deck, or, as it now must be, her main and lower deck both, upon upright timbers from the ship's keelson, are laid logs of teak about 20 in. square, and extending over a space of nearly 80 ft. in circumference. On these square timbers has been constructed the bed proper which supports the turret, turn-table, and machinery. It is in appearance a gigantic cartwheel, 26 ft. in diameter, the nave and periphery being constructed of English and American oak, the periphery entirely of banded strips of American, and the spokes of English oak. The periphery of the wheel measures 24 in. by 12 in., and the spokes each 18 in. by 12 in., all fitted with the nicest accuracy and bolted down immoveably to the square logs of timber resting on the uprights underneath. The axle to this monster wheel exists in the iron cylinders which will give entrance to the magazine below from the turn-table, and which, 26 in. in diameter, 7 ft. 6 in. in length, and 3 tons each in weight, are fixed upright through the centre of the wheel's nave; two cast-iron collars, each 6 ft. in outer diameter and each some hundredweight, being fixed, one on the upper and the other on the under side of the deck, and securing the axle or cylinder thus in its position immoveable as a rock. The upper part of this cylinder, therefore, projects upwards of 2 ft. from the wheel's nave, and becomes the pivot upon and round which the turn-table and turret revolve. From a brass collar which encircles this cylinder, next the nave of the wheel, radiate outward 24 iron rods, on the outer ends of which are fixed 24 bevelled iron wheels, 18 in. in diameter and 19 in. broad, and which, set in a double circular iron framing, work round a metal roadway laid on the periphery of the wheel, a second brass collar round the cylinder being fitted with a set of small brass bevelled wheels, the turn-table thus fitting over and round the cylinder or axis, and resting with its inner circumference on the small brass rollers, which encircle the cylinder, and its outer circumference, upon the 24 bevelled wheels, which work upon the iron roadway laid upon the periphery of the wheel. Every part connected with the ironwork of the turret, and which is being executed under the superintendence of Mr. A. Murray, Chief Engineer to the Admiralty at Portsmouth, is very massive in its character, and is beautifully finished, and, so far as any judgment may be formed at present, there is nothing to suggest the slightest fear of the "Royal Sovereign's" turrets revolving freely under the heaviest storm of shot that can be brought to bear upon them, or under circumstances of the greatest possible inclination that may be given to the ship's deck in the roll and tumble of a channel-sea. Revolving on an immoveable central axis as does a steamship's paddlewheel, it certainly appears that even 15 or 20 deg. of inclination should not interfere with the turret's working.—*Times.*

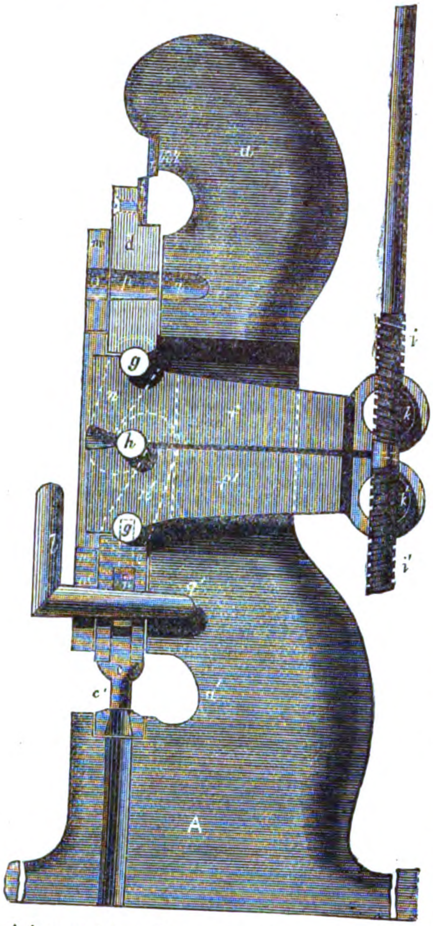
The Paris Correspondent of the *Building News* states that there is to be a combined French and Spanish Exhibition at Bayonne in 1864, which is to include objects connected with Architecture, the Fine Arts, Engineering, Mechanics, and Agriculture.

Some alterations are ordered in the sights of the pattern Armstrong guns. The frail traject-sight is abolished, and the system of double sighting on the trunnions of all field guns is to be adopted.

MACHINERY FOR PUNCHING AND CUTTING METALS.

LETTERS PATENT have been granted to M. A. F. Mennons, home and foreign patent agent, Paris, for the invention of "Improvements in Machinery for Punching and Cutting Metals"—a communication from Nicolas de Telescheff, (Captain of Artillery), St. Petersburgh, Russia.

This invention consists in an improved combination of mechanism, applied to the construction of punching and cutting machinery, as shewn by the annexed drawing, which is a vertical section of the apparatus.



A is a cast-iron frame, carrying at its upper part *a* the shears *b*, b^1, and at its lower part a^1 the the punch *c* and bed plate c^1. The lower shear blade and the punch are mounted on vertical slide bars *d* and *e*, operated by the horizontal levers *f*, f_1. *g*, g^1, are pivots or trunnions fixed to the slide bars, and bearing on the fore ends of the levers *f* f_1; *h* is a moveable axle, placed between the levers, and serving as a point of rotation to the coupling hooks *n*, *n*, by which these levers are connected with the slide bars. In the tapped bearings *k*, k^1, adjusted to the hind extremities of the levers, passes a screw *i*, i^1, threaded to the right over one half of its length, and to the left in the other half, and provided at the top with a hand bar or wheel of any suitable form. *o*, *p*, *q*, o^1, p^1, q^1, are gorges formed in the plates *m*, the slide bars, and the frame, to receive the conical keys *l*, *l*, by which one of the two slide bars is kept stationary, while the other is at work.

To cut the metal with the machine constructed as above, the keys *l*, *l*, are inserted, as seen in fig. 1, in the lower gorges, thus securing in position the punching apparatus. The screw *i*, i^1, is then turned from left to right, and by its action on the cylindrical bearings *k*, k^1, causes the hind extremities of the levers *f*, f_1, to separate, while the front ends close on each other in turning on the axle *h*. The traction exerted in this movement on the pivot *g* carries down the slide bar *d*, thus allowing the metal to be passed between the shears. The screw is then reversed, the hind extremities of the levers reclose, the fore ends reopen, and by their pressure on the pivot *g* force upwards on the metal the slide bar with its blade.

For punching, the keys *l*, *l*, withdrawn from the gorges o^1, p^1, q_1, to free the slide bar *e*, are set in *o*, *p*, *q*, and the shearing apparatus being thus secured in its turn, the levers *f*, f_1, are alternately opened and closed, under the action of the screw, in the manner above described.

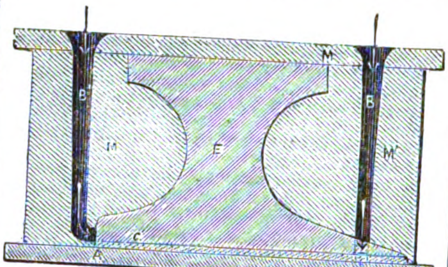
BROOMAN'S IMPROVEMENTS IN THE MANUFACTURE OF ANVILS.

LETTERS PATENT have been granted to Mr. R. A. Brooman, for improvements in the manufacture of anvils and other metal articles requiring hard surfaces—a communication from abroad by Louis Jules Duhesme, Alexandre Rey, and Ernest Muaux, all of Boutancourt, France.

The manufacture of anvils by the processes hitherto in use possesses great inconveniences. The steel table is often fixed in a defective manner to the iron which forms the remaining part of the anvil, and the anvils soon require repair or become altogether useless; they are besides very costly. The object of this invention is to overcome these defects.

The invention consists, first, in manufacturing anvils by the direct superposition during casting of two metals united so as to form one body; secondly, in the substitution of casting for forging in the manufacture of anvils, thereby diminishing in a great measure both hand labour and expense.

In a frame composed of two parts M, M^1 (see the accompanying drawing), properly adjusted, is



formed the mould, blacked with charcoal. There is nothing particular in this operation; any of the ordinary methods will answer. At the time of casting, the mould is arranged so that the surface, which is the counterpart of the table of the anvil, is at the bottom, where it rests on a plate of iron A. To form the table of the anvil, the patentee first runs into the mould E by the aperture B molten cast steel up to the point C, which point will vary according to the required thickness of the table. This operation should be effected quickly; then before the running in of the steel is stopped, but when the thickness of the steel is such as been previously determined upon, he runs molten iron into the mould through another aperture B^1 at that point to which the thickness of the table reaches. The two metals are run in together until the surface of the mass has attained a certain height; then the running in of the steel is stopped, while the iron is continued to be run in until the mould is filled. When the anvil has become tractable and sufficiently solid, it is removed from the mould, and the patentee avails himself of the heat it still retains to submit it to the subsequent stages of the manufacture, but generally subjecting it to a forge fire heated with coal and aided by a powerful blast, whereby the table is quickly brought to a red heat; he then hammers the table to render it compact and homogeneous; it is afterwards dressed or smoothened in the usual way. For the purpose of tempering, the anvil is again placed on the fire, and heated to a greater degree if possible than before, and then tempered by any ordinary process. Instead of employing ordinary cast iron, as before stated, malleable cast iron or Bessemer iron may be used.

CLARK'S IMPROVEMENT IN PISTON VALVES AND OTHER PISTONS.

THE following improvement in piston valves has been patented by Mr. William Clark, of Chancery-lane, engineer, being a communication from Mr. T. S. Davies, of Jersey City, U.S. This improvement is more especially designed for piston valves, but may be adopted in other kinds of pistons. It consists in the construction of such a valve, or of any piston with an expanding ring, having the head and follower fitted to its interior and with a dovetail wedge, so applied in connection with the ring head and follower as to make the valve or piston as much like a solid block as is desirable, yet capable of being set out to fit the cylinder in which it works and compensate for wear.

In the accompanying drawing, fig. 1 is a side view of the piston valve constructed according to this invention; fig 2 is a central section of the same; and fig. 3 is a central longitudinal section of the cylinder and steam chest of a locomotive, having a pair of such piston valves. Similar letters of reference indicate corresponding parts in several figures.

FIG. 1.

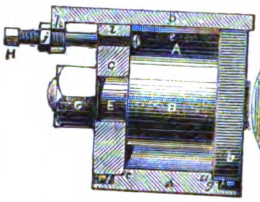
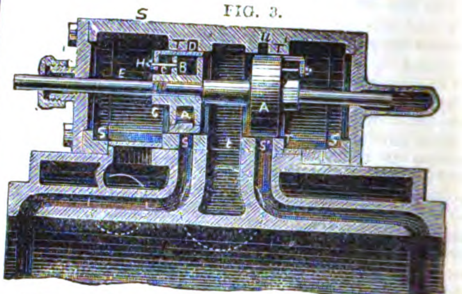


FIG. 2.

FIG. 3.



A is a single ring of cast iron, brass, or other metal, of a depth equal to the whole depth of the piston or valve, turned up externally to a cylindrical form to fit the cylinder or cylindrical seat, and having its interior turned out at one side concentrically to its exterior as shown at *a*, *a*, in fig. 2, for the reception within it of the flange *b* of the solid head B of the piston, and turned out at the opposite side in a similar manner as shown at *c*, in fig. 2, for the reception of the follower C. The said ring has cut in its exterior at any point in its circumference a taper dovetail groove *d*, *d*, for the reception of a dovetail wedge D, which is to be moveable parallel with the piston rod, and from the middle of the back of the groove the ring is cut through as shown at *l*, in fig. 2, to permit it to be set out by the dovetail wedge, the outer face of which combines with the periphery of the ring to make a complete cylinder. The solid head B is driven tightly on, or otherwise firmly secured to the rod E, and the follower C is fitted to the rod and secured by a nut G, fitted to a screw thread on the rod, the said nut holding it close up to the face of the head B and to the shoulder at the back of the recess *c*. The flange *b* has projecting from its periphery a short pin *f* to enter a notch *g* in the interior of the recess *a* of the ring, and the follower C has a similar pin to enter a similar notch in the recess *c*. These notches and pins prevent the head B, the follower C, and ring A, from turning independently of each other. The head B and follower C are received entirely, or almost entirely, within the ring A, so that the perispherical surface of the piston is unbroken, except at the junction of the wedge D; and the piston is almost like a solid block, though it can be expanded or set out against the exterior of its

cylinder or cylindrical seat as required to make it fit and compensate for wear by means of the wedge D. To provide for the convenient adjustment of the wedge D, there is applied a screw H, screwing through a tapped hole in a lug h at one end of the wedge, and having a journal i so fitted to a bearing in the follower C as to be capable of turning freely, but not moving longitudinally. This screw is fitted with a jam nut j, to secure the wedge in any position in which it may have been adjusted.

In applying piston valves for the induction of the steam to and from the cylinders of steam engines, there is provided within the steam chest S (fig. 3) a cylindrical casing or seat T, bored for the reception of the valves, which are two in number, and attached to the same stem or rod E, and the steam ports S, S[1], and exhaust port t are arranged substantially as for the D slide valve. As the outer ends of both valves are exposed to the pressure of the steam in the chests, and the inner ends of both are exposed to the pressure of the exhausting steam or of the atmosphere, the valves are perfectly balanced in a direction parallel with their axis; and to provide for balancing them in all directions radial to the axis, there are grooves u, of a width corresponding with the width of the ports s, and communicating with said ports cut all round the seat T.

BRITISH ASSOCIATION.

Mechanical Section.

An important communication on boiler explosions, from the Astronomer Royal, was read by Mr. P Le Neve Foster.

In considering the cause of the extensive mischief done by the bursting of a high-pressure steam-boiler it is evident that the small quantity of steam contained in the steam-chamber has very little to do with it. That steam may immediately produce the rupture, but as soon as the rupture is made and some steam escapes, and the pressure on the water is diminished, a portion of the water is immediately converted into steam at a slightly lower temperature and lower pressure, and this in the same way is followed by other steam at still lower temperature and pressure, and so on until the temperature is reduced to 212 deg. Fahr. and the pressure to 0. Then there remains in the boiler a portion of water at the boiling point, the other portion having gone off in the shape of steam, of continually diminishing pressure. From this it is evident that the destructive energy of the steam, when a certain pressure is shown by the steam-gauge, is proportional to the quantity of water in the boiler. By the assistance of Professor Miller, of Cambridge, Messrs Ransome, of Ipswich, and Mr. George Biddell, I have been able to obtain a result which I believe to be worthy of every confidence. I will first state, as the immediate result of Mr. Biddle's experiments, that when there were in the boiler of a small locomotive 22 cubic ft. of water, at the pressure of 60lb. to the square in., and the fire was raked out and the steam was allowed gently to escape with perfect security against priming, the quantity of water which passed off before the pressure was reduced to 0 was 2¼ cubic ft., or one-eighth of the whole. In regard to the use made of Professor Miller's theory, Professor Miller had succeeded in obtaining a numerical expression for the pressure of the steam at 12 different measures of the volumes occupied by water and steam, which expression I have succeded in integrating accurately, and I have thus obtained an accurate numerical expression for the destructive energy of the steam. In regard to the use of General Didion's experiments, giving the velocity of the ball in cannon of different sizes produced by different charges of powder, I have found which of these experiments exhibits the greatest energy per kilogramme of powder, and have adopted it in the comparison. The result is as follows:—The destructive energy of one cubic foot of water, at 60 lb. pressure per square inch, is equal to the destructive energy of two English pounds of gunpowder in General Didion's common experiments, which were made, as I understand, with smooth-bored cannon. It cannot be doubted that much energy is lost in the windage, some also from the circumstance that the propelling power ceases at the muzzle of the gun before all the energy is expended, and some from the coolness of the metal. If we suppose that from all causes one-half of the energy was lost, then we have this simple result:—The gauge pressure being 60lb per square inch, one cubic foot of water is as destructive as one pound of gunpowder. In one of Mr. Biddle's experiments the steam valve was opened rather suddenly, and the steam escaped instantly with a report like that of a heavy piece of ordnance. This is not to be wondered at, for it appears from the comparison that the effect was the same as that of firing a cannon with a charge of 44 lb. of gunpowder.

MODE OF RENDERING TIMBER-BUILT SHIPS IMPREGNABLE AND UNSINKABLE, UNDER MODERATE SCREW POWER, OR IN A LEAKY VESSEL.

Admiral E. Belcher read a long and interesting Paper on rendering ships unsinkable, by closely ceiling the holes under the planking of the hold beams, and saving those spaces between for the storage of light dry goods above the deck (which were generally lost), and placing loose planks as a temporary deck. In the event of a dangerous leak, or even a large hole being stove in the bows or bottom of a vessel, he proposed securing the hatches from beneath and the hatches from above, screwed firmly in opposition to each other, and filled in by pitch from the upper or open hatch. It was apparent that if a ship was air-tight the water could only enter so long as the air was compressible; and by inverting the pump boxes, and rendering them air-pumps the leak would not only be stopped, but by the continual action of the air it would be expelled by the very orifice by which it entered; therefore the customary and continued labour and power of the crew would not be required to such an extent, if at all, when once the necessary quantity of air had been forced in. So far back as 1823-4, he had introduced this principle at Bermuda; and, on a late occasion, when he was consulted by Mr. Marryat, chairman of the London Dock Company, as to the value of one of those lifting caissons, he proved to the parties that, by the aid of a glass tube, about 3 ft. long and half an inch bore, he could by his lungs, even at his age, effect the very same displacement which they had obtained by machinery. He then proceeded to explain, in detail, how, by pursuing his mode of construction, the vessel would not only become very much less liable to injury by the ram advocates, but, if carefully and scientifically fitted she might be over-run by an adversary, come up on the other side, and perhaps return the compliment. The gallant Admiral concluded by making a few observations on moveable armour, which might be adapted as a further protection to those vessels, which could be carried to a foreign station or long voyage in the hold, and, when war was declared, might be put on as occasion demanded.

ON TARGETS FOR GUNNERY EXPERIMENTS.

Captain Douglas Galton read a Paper on this subject. It stated that the earlier experiments made on iron plates showed that 4½ inch plates at least were necessary to resist shot. This thickness of iron still left the plate liable to be hurt or fractured and knocked off even when not directly penetrated, and the extent to which it would thus suffer would, to some extent be regulated by the backing. The plan suggested in the "Warrior" target was simply that suggested by the idea of bolting a plate of iron to the sides of a wooden ship. The iron skin of the "Warrior" is covered with two layers of teak planking, each 9 in. in thickness, the one horizontal the other vertical, and outside of those is the armour-plate, 4½ in. thick, secured by bolts screwed-up with nuts inside of the ship. The wood-backing was to prevent the injuries sustained by the plate from being communicated immediately to the ship, but it afforded no effectual support to the plate itself. The next class of targets to which Captain Dalton referred were those having a rigid backing, being wholly composed of iron. Mr. Hawkshaw had proposed one consisting of a thick front plate backed by a series of thin plates secured by rivets. Mr. Scott Russell had proposed a most ingenious arrangement by which the strong front plates were kept in position without any rivets or bolt heads being exposed. Others had also been tried. The trials of these targets had demonstrated that a perfectly rigid backing was not desirable. The arrangement required for the armour-plating of a ship, was a strong front plate, on which deflection under blows should be prevented, but which should have some cushion behind to prevent the full concussion of the blow being communicated to the side of the ship. The target to which he (Capt. Galton) wished to draw attention, was constructed on these principles, and was shown in the diagram. It had the metal placed in a form suited to resistance, and it had a cushion of wood interposed between the target and the ship. This target was invented by Mr. Chalmers. It consists of—1, a thick front plate, as the top flange of a beam; 2, of ribs to support it, as the web of a beam; and 3, of a plate of iron to hold up the ribs, as the bottom flange of a beam, and the ribs are supported laterally by timber to prevent their lateral deflection. Between this and the side of the ship a cushion of timber is interposed. This target underwent a similar trial to the "Warrior" target, and the result showed that it was the best target that had been tried, though it was not intended to suggest that it was perfect. It was, however, in this direction that experiments for devising the best form of armour-plating should be made.

RIFLED ORDNANCE.

Mr. Geo. Richards read a Paper on this subject, which was illustrated by diagrams representing the square-bore gun of which the Paper treated. He stated that the purpose of the square-bore gun was to give greater initial velocity to projectiles than was attainable by any plan yet proposed, inasmuch as the area of the square bore was at least 20 per cent. more than that of the circular bore containing a shot of the same diameter, thereby exposing, by using a wad or sabot, a greater surface to the impact of the ignited powder. The invention embraced two principles:—In the first place, the square bore gave at least 20 per cent. more initial velocity than the round bore of the same diameter; and secondly, the plan of obtaining increased velocity to any extent was by means of projections or rails in the interior of the bore on which the shot runs or slides, there being the necessary amount of twist to give the shot the rifled motion. In both cases the sabots would be used to act as air-tight pistons, but might be dispensed with by using wedge-like shoulders on the periphery of the shot to fill up the angular spaces of the bore, and also to give the shot the piston-like qualities sought to be obtained. This principle of presenting an increased surface to the propelling power of the gas was considered to admit of an extra power in aid of velocity of 15 tons to the square inch. Those forms of bore would admit of shot whose transverse section might be either square, hexagonal, octagonal, cylindrical, or other geometrical or polygonal forms of areas. In addition, Mr. Richards showed a method of loading heavy ordnance (applicable to sea service) by means of a loading-rod. The method of loading the gun was by means of a loading-rod passing through a perforation in the breech of the gun, and thence to the muzzle. The cartridge used was also made with a perforation through which the loading-rod passes. The loading-rod was quickly attached to the base of the projectile at the muzzle of the gun. Both rod and charge were quickly drawn into the chamber of the piece, disconnected in readiness for loading, and the breech was then closed by a small apparatus, such as a revolving disc.

ON THE DECORTICATION OF CEREALS.

Mr. Robert Davidson, C.E., read a Paper on this subject. The Paper described a plan by which the outside gummy and resinous pellicle, the inner thinner skin, and beneath it a third envelope, formed of impalpable dust, were removed from the grain. These three envelopes form the bran. The advantages obtained by their removal was 10 per cent. increase in quantity of flour (at least upon wheat), and 12 to 15 per cent. upon barley and oats; and, at the same time, a finer colour and a better taste. It was contended that decortication was advantageous in a hygienic point of view.

ON IMPROVEMENTS IN MACHINERY, AND APPARATUS FOR CLEANSING AND PURIFYING CASKS.

A Paper on this subject was also read by Mr. Davidson. The machine, a model of which was exhibited upon the table, consisted of a double frame, suited to the form and size of each cask, revolving one within the other in such a compound manner as to cause a chain of peculiar construction, assisted by hot water, to traverse completely every portion of the cask, and so effectually remove all adhering matter. Eight casks can be washed at once, as shown by the model.

The *Pays* states that the two iron-clad ships building by Mr. Laird at Birkenhead are not constructed for the French Government, but that they have been ordered by the Government of Egypt, as their names indicate.

FELL'S LOCOMOTIVES.

FIG. 2.

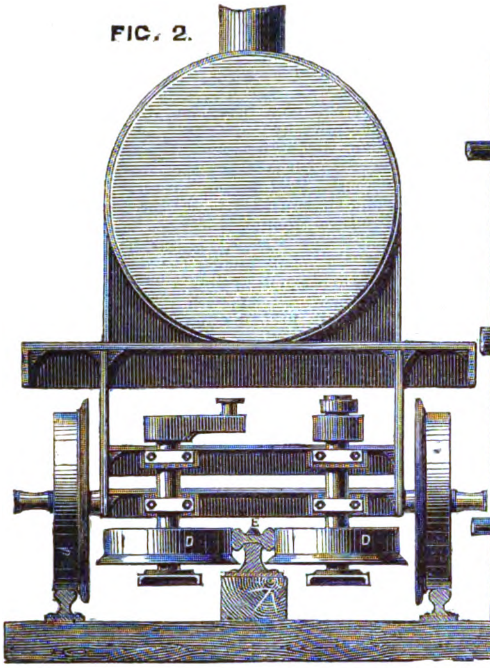
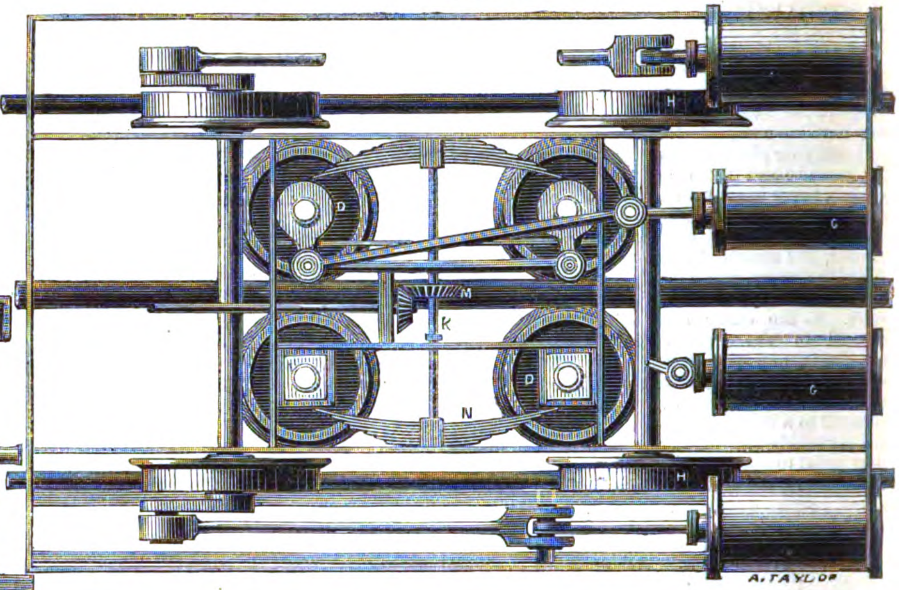


FIG. 1.



WORKING RAILWAY ENGINES AND CARRIAGES ON STEEP INCLINES.

THE following inventions for improvements in working railway carriages and engines on steep inclines have just been patented by Mr. John Barraclough Fell, engineer, of Sparkbridge, Lancashire. The object of these improvements is to enable locomotive engines and carriages to travel up and down steep inclines with facility and security. For this purpose the patentee applies to the engines and carriages, wheels in pairs or sets of two or more, so arranged as to work on either side of a central rail, and to press and hold on such rail with a pressure and holding adapted to the circumstances of each case. In travelling up inclines the wheels of each pair or set are worked by the engine at a speed and with a pressure on each side of the central rail according to the load and the rate at which the engine has to travel, and the adhesion necessary for taking the load up the incline. In descending the inclines these pairs of wheels on the engine and carriages are employed as brakes, with an adhesion adapted to the load. These pairs of wheels also hold on either side of the central rail, in such manner as to afford a great amount of security against the wheels of the engines or carriages jumping and getting off the lines of rails on which they are travelling.

In the accompanying drawings, figs. 1 and 2 represent the plan and end elevation of a locomotive engine, which, independently of the ordinary bearing and driving wheels, is furnished with two or more horizontal wheels D, D, pressing against the central rail E. The wheels D, D, are driven by two additional steam cylinders G, G, as shown by the plan, fig. 1. A transverse shaft K is provided with a right and left-handed screw, which being acted upon by the wheels M, M, draws together the springs N, N, by means of which the horizontal wheels are made to press upon the central rail, and so obtain the amount of adhesion required. Horizontal wheels may be also attached to the carriages and waggons, and constitute so many brakes. For the descent of steep inclines the horizontal wheels of the engines may be reversed, in order to check the speed, or to secure the immediate stoppage of the train. The additional adhesion wheels, shown in figs. 1 and 2 in a horizontal position, may, if preferred, be placed at an angle of 45 deg., or less, and may have their tyres cylindrical or grooved. In order to avoid friction in a vertical direction between the wheels and the central rail resulting from the movement of the engine on the springs which support it, these wheels may be so fixed on the axles as to allow them whatever vertical play may be needful. The pressure of the horizontal adhesion wheels upon the rail on which they work may be produced by means of a steam cylinder, or by water pressure, or by the use of springs of any convenient form.

The steam cylinders employed for rotating the horizontal adhesion wheels may be placed in the position shown in fig. 1, or fore and aft in the centre of the engine; or instead of being so placed, they may be placed vertically together at either end of the engine, or in the same horizontal plane, and be so inclined as to work on the same axle. In the first illustration the cylinders cannot be conveniently coupled without the use of toothed wheels, which are dispensed with by different arrangements.

It will be readily understood by all who are conversant with the construction of locomotive engines and the working of railways, that the disposition as well as the proportions and arrangement of the parts must necessarily be varied in each case to suit a particular type of engine; and it will be also understood that the horizontal adhesion wheels can be applied to the tender of the locomotive engine, and be worked by means of independent cylinders contained within the engine framing, or applied within or under the tender and receiving steam from the main boiler. In like manner, when it is deemed advisable, horizontal guide or adhesion wheels may also be applied to the under side of the brake carriage or waggon, or any other carriage of a train, and be worked or rotated by means of steam or other power, either from the cylinders contained within the locomotive framing or the tender, or connected to the carriage itself; and such means of rotating the adhesion wheels may receive the power from the main boiler of the locomotive engine by means of steam pipes communicating therewith; or motion from the horizontal adhesion wheels on the engine may be communicated to similar horizontal wheels fitted to the tender, or to the following carriage or carriages, by means of coupling rods, the cranks of the engine and carriage being coupled by double rods and an intermediate crank as a transmitter, and also as a means of compensation whilst passing round curves. The pressure of steam in the boiler may also be employed for producing the requisite amount of adhesion between the horizontal wheels and the central rail, or it may be applied by hand.

MELLOR AND WHALEY'S IMPROVEMENTS IN STEAM-HAMMERS.

THE following improvements in steam-hammers have been recently patented by Messrs. William Mellor, of Manchester, and William Whaley, of Rainow, in the county of Chester. The invention consists in communicating motion to the slide valves of steam-hammers, and other engines driven by steam, by means of a screw which passes through a nut formed in the piston, so that as the piston moves up and down or to and fro in the cylinder, the screw is turned round in opposite directions. This screw is made of the same piece, or attached to another screw acting on a nut connected to the lever to which the valve spindle is jointed; by this means the slide valve is moved to and fro to open and close the steam ports in the valve box. Another part of the invention consists in connecting the valve lever to a rod acted upon by levers and rods, for the purpose of varying the position of the fulcrum of the lever, so as to increase or diminish the length and force of the stroke.

The invention admits of modification, by placing the screws to one side of the piston rod; in this case one of the screw nuts is connected to a projection on the hammer-head, and the other is connected to the valve spindle.

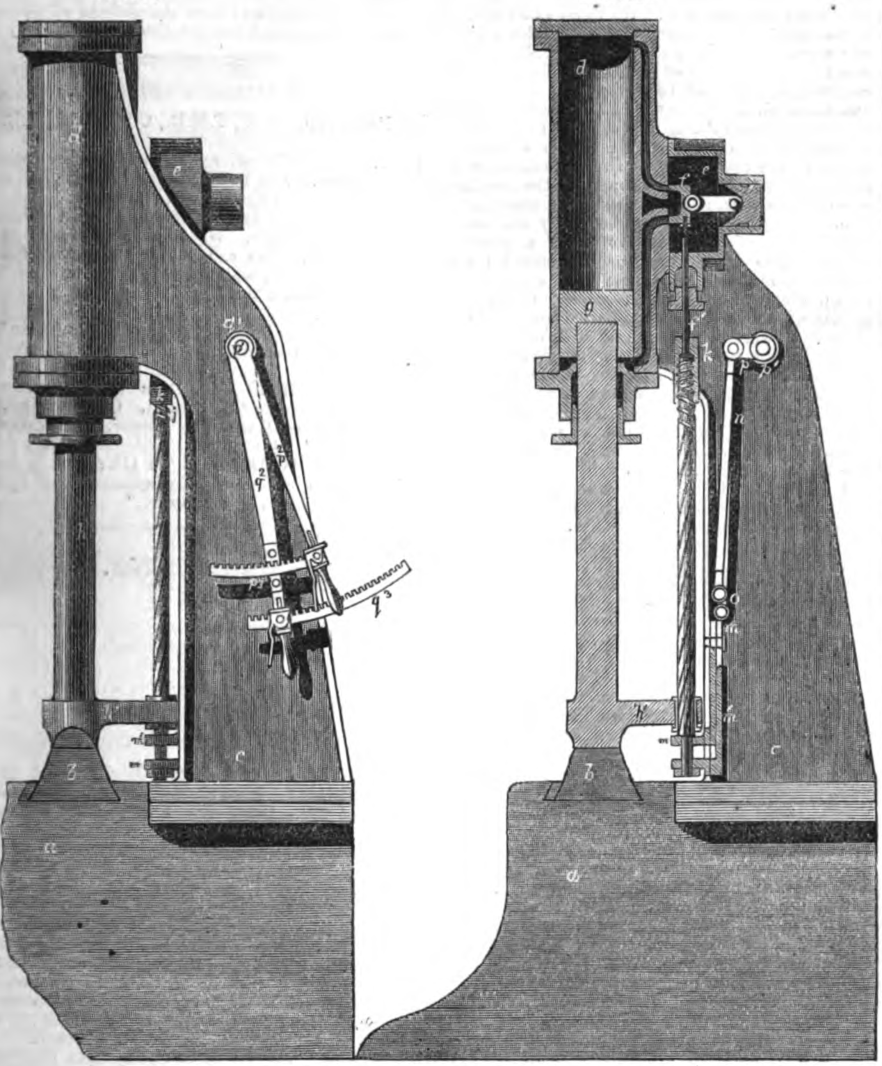
The patentees state that they describe these improvements as applied to a steam-hammer, but they are applicable to all or most engines driven by steam.

Fig. 1 of the accompanying drawings is an elevation of one form of steam-hammer, constructed according to this invention, and fig. 2 a section of the same. a is the anvil block and foundation plate; b, the anvil; c, the standard, cast of the same piece as the cylinder d; e is the steam chest or valve box; and f, the valve; g is the piston; and h, the piston rod, the lower part of which forms the hammer-head.

The screws i and j are placed to one side of the piston rod h, to which is connected the projection h^1 containing the nut working in the screw i. The nut k of the screw j is fixed to the spindle f_1 of the valve f; this nut passes through a bush in the standard c, and is provided with a key to prevent it turning round, but to allow it to move up and down. The vertical position of the screws i and j, and consequently the relative position of the valve f to the ports in the cylinder, can be regulated by the handle levers p^2 and q^2, which act respectively on the slides m, m^1; these sliders

MELLOR AND WHALEY'S IMPROVEMENTS IN STEAM HAMMERS.

FIG. 1. FIG. 2.



have projections at their lower extremities through which the end of the screw i passes.

The mode of operation is as follows:—When the piston g rises in the cylinder d, the nut in the projection h^1 of the piston rod h causes the screw i to rotate, thereby turning the screw j round in the proper direction for elevating the nut k and valve f, as described.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

On the night of Saturday, the 5th inst., the monthly meeting of members of the above-named society took place at 35, St. Swithin's-lane, City —Mr. Joseph Newton, President, in the chair. After the minutes of the preceeding meeting had been read, the auditors for the half-year just expired presented their report, which showed that, in a numerical and financial sense, the association was in a prosperous condition.

The Chairman next called upon Mr. Gettliffe to read his promised Paper on "an Apparatus for the Prevention of Steam Boiler Explosions and Railway Accidents." That gentleman, after some preliminary observations, proceeded to say that the apparatus in question was the invention of M. Auguste Achard, C.E., of Paris, and that it was known in France under the title of the "Embrayage Electrique." It was calculated to maintain a constant level in steam boilers by automatic means, and without the assistance or supervision of the engineman. This regulator, as it might be termed, consisted of a ratchet wheel of peculiar construction, and which was keyed upon a spindle turning freely in its bearings Right and left of the wheel were mounted, loosely on the spindle, two wrought-iron levers of about 20 in. each in length, and connected together by cross-pieces. A two-armed "click," supported by the levers, turned freely round an axis. The double click acted freely upon the ratchet wheel, which was furnished with two sets of teeth, turned in opposite directions to each other, and separated by a blank space. The click was fitted with a tail-piece in the form of a fork, the two prongs of which were braced together by a cross rod. In the fork was mounted an "armature," which was provided with an opening through which passed the cross-piece. The armature was made of brass, and to it was attached a plate of soft iron fitted in so as to be flush with the surface of the armature. Opposite to this latter was placed a horizontal electro-magnet, the poles of which abutted against the armature in such a way as that it (the armature) could only slide against the poles without coming into immediate contact therewith. The part played by the armature was merely to act as a weight on the levers supporting the fork; for it would be understood that when the electric current was in circulation, the armature would be suspended by its adherence to the electro-magnet, and thus relieve the fork of its weight. The suspension of the current, on the contrary, would cause it to drop on the cross-piece connecting the levers, and thus alter the gravity of the fork. It was these alternations of the weight on the tail-piece of the levers which caused the fork to act upon the upper or lower set of teeth on the ratchet wheel; or, in other words, to open or shut the feed-cock of the boiler. It was necessary that the fork should have continual motion—a kind of pump-handle movement, indeed—which could be effected by a simple contivance (a small eccentric, for instance, attached to a running shaft on the general machinery). The effect would be that the compound ratchet wheel would be acted upon and moved in one direction when the boiler required feeding, and in the other when it had been fed sufficiently. If all were going on well, the click would simply move over the blank portion of the wheel, and communicate no motion whatever to it. Proceeding now to the general action of the contrivance, the reader proceeded to state that when the current was broken off from the electro-magnet, the weight of the armature operating upon the cross-piece would press down the tail-piece of the levers carrying the click, which latter would rise and act with its lower arm upon the ratchet wheel. The consequence would be, that the wheel would turn from left to right to the extent of one tooth, or about half an inch, at each oscillation of the levers, until the blank space presented itself and stopped further movement. This would be at a point when the wheel had made one-fourth of a revolution. On the other hand, when the current was in circulation, the armature, in sliding against the poles of the electro-magnet, would bring the plate of soft iron into contact with the poles, which would then hold it firmly, and prevent the armature descending with the click during the downward oscillation of the levers. The tail-piece would thus be relieved, and not have to support any weight while the levers rocked in the opposite direction. It would follow that the upper arm would then act upon the wheel, and cause it to turn the reverse way, *i.e.*, from right to left. It would thus become evident that the two-armed click would act on the ratchet wheel, and cause it to move in opposite directions, whether the electric current were traversing the electro-magnet or not. "Now," said the reader, "the characteristic feature of the electric regulating apparatus is arrived at." The rising or falling of the float in the boilers of stationary or land engines controls the electric current, and causes it to circulate or be interrupted at the proper times. This result is obtained directly by the wires which proceed from the pile or battery being made to pass first to the float instead of being connected immediately to the electro-magnet. The float itself was connected by a rod with an index, on the lever of which was mounted a piece of wood faced on one side with a brass plate. On another piece of wood, in the form of a rocking lever, and moving on an axis, was a second plate of brass. The electric wire from one of the poles of the battery was fixed to the first-named plate, and the other end of the wire, after traversing the electro-magnet, was attached to the other pole of the battery. In order that the current might circulate, it was indispensable that both plates should meet, and from the peculiar arrangement of the two metallic plates, they would always be in contact when the index was at zero (the normal feeding point) or above it, but the contact ceased as soon as the index fell below zero. Let it be supposed that the feed-cock of the force-pump, or other contrivance for supplying water to the boiler, was connected to the spindle of the ratchet wheel: it would follow that the cock must partake of the movement of the wheel, and that it will make a quarter of a turn in one direction when the electric current circulated, and a quarter of a turn in the other when the current was interrupted; thus the automaton regulator, which was sensitive to the smallest alteration in the water level of the boiler, was perpetually and inevitably maintaining it at a constant height, and thus one great source of danger was obviated. As an extra security, however, against accident by explosion, a minor contrivance was affixed to the same apparatus, and which owed its action to similar principles. On the side of one of the levers was fastened a cap with a gudgeon in its centre. An armature resembling that already de[illegible] was carried

by this cap and rested on the gudgeon. In connection with the second armature was placed an electro-magnet, against which it was made to slide and press constantly upon the poles. It was still the index of the water gauge, which induced the circulation or effected the interruption of the electric current; and the same electric pile or battery, composed of a single element, or Daniel's pair, sufficed to put in motion the two electro-magnets. The electric wire which proceeded from one of the poles of the battery, and was affixed to the brass plate on the lever of the index, served for the two electro-magnets also. The returning wire corresponding with that about to be described, however, was fixed to a third brass plate, and, after traversing the electro-magnet was attached to the second pole of the battery. The last-mentioned plate was arranged in such a manner as to establish a metallic contact, which permitted the electric current to pass, notwithstanding the variation in the level of the water to the extent of an inch above or below its proper line. If the variation exceeded these limits, the current would be forcibly broken. When the electric current was in circulation—that is to say, when the lever was between the limits of variation named—the armature would be suspended by the adhesion of the second electro-magnet; but if the level rose or fell beyond those points, the armature, from the current being broken, must fall. In either case, a small tappet fixed to the armature below the gudgeon touches an alarm lever and thus rings a bell. This arrangement was also serviceable in other respects. The alarm bell rings when the feed-pump is out of order; when the electric pile ceases to act; if the stoker neglects the fire; or if steam is generated too rapidly. The reader proceeded to point out the application of the "Embrayage Electrique" to the prevention of railway accidents by connecting it with brakes upon the wheels of the engines and carriages, and certainly gave some very practical illustrations of its value and efficacy in this respect. In France it is extensively used, and testimonials in its favour from many eminent scientific men were submitted to the Associated Foreman Engineers on Saturday night. Mr. Gettliffe, moreover, exhibited the apparatus itself to his audience, and thus gave them a further opportunity of judging of its characteristics.

On the conclusion of the Paper, a short discussion arose; and in this Messrs. M. Jones, Ives, Briggs, and Bragg took part. In reply to questions put by these gentlemen, the reader stated that at the works of Mr. Cater, engineer, &c., Grove, Southwark, an apparatus of the kind he had attempted to describe might be seen in daily action, as also at Messrs. Simpson's, in Little Britain, City. The office of M. Achard was at 1, Little Carter-lane, Sr. Paul's.

The Chairman then proposed a vote of thanks to Mr. Gettliffe for the able way in which he had explained an ingenious apparatus of great interest to the members of the Society of Foremen Engineers. He had, from what he had heard and seen on that evening, formed a good opinion of the contrivance, and he should take an early opportunity of witnessing its action. The time was approaching when Electricity would become a universal handmaiden to applied science, and mechanical men would do well to study closely its phenomena. M. Achard had, in the production of his "Embrayage Electrique"—in substitution for the title of which an English one must be found as expressive—demonstrated his great talent, and in Mr. Gettliffe he had found an excellent expositor.—The vote of thanks having passed, the meeting shortly after separated.

PISTON SPEEDS OF BEAM ENGINES.

At one period of the science of steam engineering it was the practice to fix the limit of the speed of the piston at so many feet per minute; and from this and the other data usually taken into account—as the area of the piston, pressure of steam, &c.—the horse-power of the engine was calculated. If we are not in error, 250 ft. has been set down as a standard speed for pistons; but modern engineers prefer to drive their pistons as fast as they can with safety, and to disregard rules which experience proves the uselessness of. We have, as a result, the performance of the engine of the "Golden City" (a new steamer belonging to the Pacific Mail Steamship Company). It is of the beam variety, the beam weighing upwards of 18 tons. This engine has a piston 105 in. in diameter by 12 ft. stroke, and upon a recent engineers' trial trip, achieved the remarkable speed of 420 ft., or 47½ double strokes per minute. We have no doubt that the engine will be able to add materially to this speed, as the machinery was entirely new, it being merely an experimental trip. This is not an isolated case, by any means. The "City of Buffalo," formerly a passenger steamer upon Lake Erie, now dismantled for the want of trade, had an engine with a cylinder of 76 in. diameter and 12 ft. stroke, which drove paddle-wheels 34 ft. in diameter, whose floats had 31 in. face, were 11 ft. long, and had from 36 in. to 40 in. dip—19½ revolutions, or 39 single strokes per minute. By a severe exercise of mathematical knowledge, we ascertain this to be a piston speed of 468 ft. per minute. We remember these facts and figures very well, as at that time we were pretty much occupied in looking after the engine aforesaid. The beam weighed nearly 16 tons, and was stopped and started 39 times in a minute, working with great ease and certainty. The beam of a beam engine appears to some to be an insuperable obstacle to the general adoption of the class of engines to which it belongs; and its weight, momentum, velocity, &c., are charged heavily to its demerit. These theories, we fancy, are disturbed by the actual facts in the case, which are, that the beam is so poised and balanced on its centre, that the supposed shock of changing its line of motion is utterly neutralized; and as for the weight, that is supported by the framing, and is no more against the power exerted by the piston than the smoke stack. A beam, weighing 15 tons, or 18 tons, can be moved through any portion of its arc of vibration, by the strength of a man; providing, of course, that the binders of the pillow blocks are not screwed up, and that the journals sit fairly on the brass. The above-cited cases of the speed of beam-engine pistons are all distanced by the extraordinary performance of the "C. Vanderbilt," a Sound steamer, in her race, June, 1847. This engine is of 65 in. cylinder and 12 ft. stroke, and on the occasion mentioned, attained to 540 ft., or 22½ double strokes per minute. It is not at all uncommon or extraordinary to obtain a piston speed in beam engines of 400 ft. per minute, in this country; but the performance of the "Golden City," we think, is the best on record, considering the size of the cylinder.

Since writing the above, we have ascertained that all the facts just mentioned are below the mark. The "Mississipi," a large paddle steamer, having an 81 in. cylinder and 12 ft. stroke, has made 24 revolutions per minute, the wheels having 36 in. dip, and attaining a piston speed of 576 ft. per minute. The "Metropolis," a large Sound steamer, having a cylinder of 105 in. diameter and 12 ft. stroke, has made 20 revolutions per minute, and we think a higher number. The working beam on the "Mississippi" weighs 14 tons; that on the "Metropolis" about 16 tons. The engine of the "New World," a side-wheel steamboat 420 ft. long, on the Hudson river, having a 76 in. cylinder, and 15 ft. stroke, has made 20 revolutions per minute or 40 single strokes. The "Richard Stockton," however, has outstripped the whole fleet, and, we think, attained the highest piston speed for an engine of this class ever made in the world. We do not know the exact dimensions of the cylinder, but have been told it is between 50 and 60 in., with 10 ft. stroke. The "Stockton" has feathering wheels, and makes 32 revolutions, or 64 single strokes per minute; and has done this duty for years, having been built by Robert L. Stevens, for the express object of testing the speed at which a piston could safely travel. This is the highest speed within our knowledge ever attained by a piston in an engine of similar size; if any other instances come to mind we shall place them on record. It would be difficult to point out any other class of marine engine of the same size as that in the "Golden City," which could achieve 17½ turns a minute, and keep it up as a regular duty. The standard of 250 ft. per minute will have to be changed, and made to suit modern pistons, as the engines themselves stubbornly refuse to be controlled by any such snail-like movement.

[We give the above extract from the *Scientific American* as an instance of the high speeds which pistons may attain under the most unfavourable conditions. From the dictum of the writer in favour of the beam arrangement we altogether dissent; the rapid increase in the number of direct-acting engines employed in Great Britain proving conclusively that the defects of the beam are not theoretical but practical.—ED. M. M.]

TO CORRESPONDENTS.

RECEIVED.—E.X., T.M.R., C.W., A.N., T.B. and Co., C.K.

T. D. P.—We believe the annual subscription is one guinea. You had better write to the secretary. If you direct to Kew it will reach him.

H. M.—Many descriptions have been published from time to time. We know of none so full as you require. You can get all the Patent Specifications, however, which deal with the subject, from the Patent Office by addressing a line to Mr. Bennet Woodcroft.

R. B.—Patented long ago by Mr. Train, and described in the MECHANICS' MAGAZINE for Feb. 22, 1861.

A BLACKSMITH.—Ede, "On the Management of Steel." Tweedie, 337, Strand. One Shilling.

ERRATA. — Rankine's Paper, "MECHANICS' MAGAZINE," 28th August, 1863—page 607, col. 2, line 41, for "QOA," read "2 OA;" col. 3, lines 9 and 10 from bottom—for "displacement of speed," read "displacement and speed."

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

HIGH SPEED IN, AND ARMAMENT OF, OUR NAVY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Your Paper upon "High Speed in the Navy" cannot fail to arrest the attention and engage the serious thoughts of all who are interested in the well-being of England.

That England's exalted position has been attained by, and depends to a great extent upon, her undisturbed commerce, is generally admitted—to her maritime strength these conditions are mainly due.

If, therefore, England should ever again be involved in war with a naval power, the efforts of her foe would be bent upon the capture, or extermination, of her mercantile marine. It behoves her, then, to provide, while at peace, every means for its protection; such means being suited to meet the modes of warfare likely to be adopted.

No course can be more futile than that which is disregardful of the changes that are being induced by destructive appliances, little dreamt of in the days of Nelson, when large ships and heavy ordnance were looked to, and relied upon, as the bulwark. In the present state, however, of the art of war, large ships and heavy ordnance will be found useless—worse than useless—by reason that monster vessels will, upon the ocean, need protection, rather than be enabled to afford it. The much-vexed, but little understood problem of the torpedo, or submarine explosive shell, is in the course of solution on the other side of the Atlantic. It will ere long be, in all probability, found that such engine of destruction is very much more formidable in "blue water" than in rivers. Though the *active* mode of the employment of the arm in question, is that which would be resorted to by vessels adapted to its service, yet in a *passive* form only it would be an obstacle to the movement of attacking vessels that would prove, if not completely destructive, so damaging, at an rate, as to compel them to remain stationary.

Shell vessels need only to be lightly armed with cannon; one gun, or two guns at most, of long and accurate range, but of small weight, to bring to an unarmed or merchandise vessel; using the principal arm, the submarine shell only, when necessary. In such arrangement, there is nothing detrimental to speed—the conditions admit o[illegible] build to embrace a light draft of water, and [illegible] tonnage to carry comparatively a large suppl[illegible] fuel. These vessels may be so constructed a[illegible] endure any amount of rough weather without [illegible] of foundering—under a condition when [illegible] could not be safely cast loose, much less u[illegible] any degree of precision, by reason of ther[illegible] too much sea on, they would be most for[illegible] especially so, in the darkness of night. B[illegible] statements have been often expressed; [illegible] not be repeated. For the proof of thei[illegible]

they must abide their time, like other important truths that have been for long periods suppressed.

This is, in truth, a subject for contemplation.

I am, &c.,

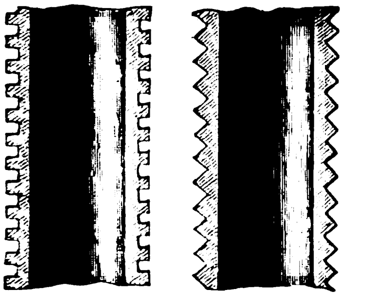
JN. HARVEY, Capt. R.N.

5, Keynsham-parade, Cheltenham,
Sept. 7, 1863.

LOCOMOTIVE IMPROVEMENT.

SIR,—Much has already been done to increase the heating surface of steam boilers, but I think a further improvement may be effected by increasing the *surface in contact with the water*, without a further increase of the absorbent surface.

It is pretty generally known that flanges cast on air warming apparatus, as applied by the London Warming and Ventilating Company, greatly increase the effect of such apparatus, the cause being that a greater surface of heated metal is in contact with the air. I think, therefore, that if the metallic surface of tubes, flues, &c., of boilers, in contact with the water, be increased in area, an increase of evaporation will ensue. This may be effected in several ways, varying with the form of boiler; but, in the case of locomotive boilers, the two modes shown in the accompanying sectional diagrams might be found most simple and effective.



Neither the thickness or the weight of the tubes need be much, if at all, increased.

I am, &c.,

T. MOY.

Clifford's-inn, Sept. 5, 1863.

FOG NAVIGATION.

SIR,—If behind the fog-whistle of steamers were placed a revolving reflector—said reflector being of the proper form to cover an approaching craft with the collected rays (sound waves)—would not the sound be intensified, and, moreover, the quicker attract attention from its being

INTERMITTENT?

San Francisco, July 30, 1863.

Miscellanea.

There are at present two distinct telegraphic lines being laid down to the extreme south-western coast of Ireland—one to Crookhaven by Mr. Reuter, and the other to Cape Clear by the Magnetic Company. As this part of Ireland is the nearest to America, intelligence from the other side of the Atlantic will be received in Europe earlier than would otherwise have been the case. Both lines are completed to within about 8 miles of Skibbereen.

Mr. M. Assman, a Prussian-Polish Jew, resident in Fawcett-street, Sunderland, has invented a clock which keeps time on what he claims to be a new principle of metallic motive power. The clock has neither weights, chains, springs, nor pendulum, and keeps time without the slightest noise or ticking. The principle of the clock is so simple that it will need little or no regulating or repairs, and the inventor believes it will surpass in time-keeping the most correct watches and chronometers now in use. Mr. Assman intends shortly to exhibit his clock.

On Saturday last the iron paddle steam-vessel "Normandy," built by Messrs. Ash, of Millwall, for the South Western Railway Company, and intended for the mail and passenger service between Southampton and the Channel Islands, left Blackwall with her commander, Captain Babot, and a numerous party on board, for a trial trip, to test her machinery and engines, which are manufactured by Mr. John Stewart, of Poplar. During the trip to the Nore her engines, which are 225 nominal horse-power, were worked up to eight times that amount, or 1,800-horse power, and a speed of 17 knots per hour was obtained. The cabins, &c., of the "Normandy" have been fitted-up and furnished in excellent style for the accommodation of 150 passengers, and she is capable of conveying 250 tons in addition. Her draught of water is 8 ft. 9 in. aft. and 8 ft. forward.

Sir W. Armstrong's alarmist views upon the speedy exhaustion of English coal are disputed by Mr. Nicholas Wood, the great coal-viewer in the North, and perhaps the highest practical authority in England upon coal-mine questions. In the Geological Section at the British Association meeting, he has stated his reasons for believing that our supplies of coal will last much longer than the 200 years allotted by Sir William, and he refuses to believe that American manufacturers will one day enjoy vastly superior advantages in this particular over those now possessed by Englishmen. Mr. Wood relies much upon the coal deposits under the sea, as to the extent of which we know little, but which he believes will one day yield large supplies.

The electric light has been adapted for surgical purposes. A great difficulty in many operations is the want of light, and by means of a small vacuum tube, bent into a helix or screw, a kind of luminous cylinder is formed, which may be introduced in very narrow cavities. Carburetted hydrogen, carbonic and hydrochloric acid are used in the vacuum tube to produce whiteness in the light.

A serious fire has broken out in the Wellington Pit, at Whitehaven, the property of the Earl of Lonsdale. The pit is one of the largest in the kingdom, and the accident will throw abont 700 men out of employment, besides affecting the coal supply to Dublin.

From Sir R. Murchison's address at the anniversary meeting of the Geological Society, it appears that Sir Roderick (the greatest living authority on such a subject) believes, first, that the eastern shores of Great Britain, where Cæsar landed, have not changed their relation to the sea-level since that period. Secondly, that it is proved, from finding remains and bones of the same species of extinct mammalia in the gravel of Britain and the Continent, that at a comparatively recent period our islands were united with France. Thirdly, we know from the skeletons of the great Irish elk, which are found in the bottom of the bogs in Ireland, and also in the Isle of Man and in Cheshire, that when that creature lived these three islands must have been united.

The Abbé Moigno exhibited and described before the British Association M. Soleil's tenebroscope for showing the invisibility of light. The instrument consists of a long tube, closed at one end, but with a short opening in the centre, in which is introduced a white ivory ball, capable of being placed and withdrawn at pleasure. The object of the instrument is to illustrate the principle that light is only the action of the illuminiferous medium by which bodies are made visible; and that neither the light itself or the the medium, is visible. On looking through the glass with the ball withdrawn no light is seen, but immediately on the ball being replaced it is distinctly seen at the end of the tube.

A meeting of the citizens of Exeter and noblemen and gentlemen of the county of Devon met at the Guildhall last week, the Mayor in the chair, and unanimously agreed to take active measures to invite the Royal Agricultural Society to hold its meeting in Exeter in 1865. £600 was subscribed.

The *Post* announces that the Government intend to detain the two steam-rams "El Tousson" and "El Mounassir," at Liverpool. Our contemporary says:—There is now, we believe, little doubt that, under the terms of the Foreign Enlistment Act, they are now to be detained by Government. The allegation against them is that they are fitted out for the purpose of carrying on hostilities against the United States. On the other hand, it is not contended that they were built by order of a French house for the late Pasha of Egypt, who gave the firm a commission for the coinage of a large sum of money in France, and for the construction of two steam-rams in England. The money was duly coined and received in Egypt. The vessels were in construction when the Pasha died, and his successor repudiated that part of the contract. What the French house intends to do with them is not known. The accusation is that they are destined for war with a friendly Power. They will consequently be detained, and a court of law will determine whether, under the terms of the Foreign Enlistment Act, the detention is legal, or whether the owners can recover them from the hands of the Government.

The meeting of the British Association at Newcastle has now terminated, and has fully justified the high anticipations that were formed respecting it. The society, urged by Mr. Tite, M.P., and the Mayor of Bath (Dr. Barrett), have resolved to hold its next meeting in Bath. Sir Charles Pressley will be the President for 1864. The following officers have also been appointed:—Vice-Presidents: Lord Portman, the Marquis of Bath, Wm. Tite, Esq., M.P., Arthur Way, Esq., M.P., William Sanders, Esq., F.G.S., Lord Nelson, and T. H. Dickinson, Esq. Local Secretaries: Charles Moon, Esq., C. C. Davis, Esq., and the Rev. W. W. Winwood. Treasurer: Thos. Gill, Esq. The meeting was fixed for September, but the day for its commencement will be a subject for future discussion.

It is claimed that the Ferris gun, a newly invented weapon, gave a speed of 2,200 ft. per second to its shot, as measured by the electrobalist at West Point. The gun was tried in the presence of numerous officers of high standing in the army. The highest velocity ever obtained before was with a Parrott gun, the speed of the projectiles from which was 1,800 ft. per second. The Ferris gun obtained its high velocity from the quantity of powder burned in it, which is, in a 14-inch bore, 24 ounces, while the shot weighs 40 ounces—rather more than half the weight of the shot. At this rate the 100-pounder would require 60 pounds of powder, and the 200-pounder nearly 100 pounds—a fearful charge, certainly.

Horatio Ames, of Falls Village, Conn., proposes to make for the American Government fifty 300 lb. rifled cannon, to carry a 100 lb. charge of powder; price of the weapon 1 dol. per pound. The guns are intended to be nearly 10 in. bore, and weigh 30,000 lb. a-piece. They are intended to stand 1,000 rounds without bursting. We presume there are a great many forges willing to make such guns on similar terms.

The *New York Times*, in speaking of the attack on Fort Sumter, says:—An ingenious device of the rebels for blowing-up the shipping in Lighthouse Creek was recently discovered. It consisted of three metallic cases, of oval shape, fastened together by a strong cord. These cases are filled with powder, and upon the sides which float uppermost are delicately arranged hammers, with which a percussion-cap, hidden in a coating of gutta-percha, is to be exploded. These hammers stand out from the water at an angle of 45 degrees, so that when the cord shall have caught upon some cable, and the torpedoes shall have swung against the vessel's side, an explosion is inevitable. To General Vodges belongs the credit of bringing to light this infernal invention. With his sharp eye he discovered the mysterious contrivance floating on the descending tide, and at his instance a party of sailors was despatched by Captain Bacon, of the gunboat Commodore Macdonald, to pick it up. It was lucky for the little transport "Nantasket" that the torpedo was rescued from the water as it was, for in a moment more it would have been thumping under her bows.

The Act passed on the day of the prorogation to regulate the exercise of powers under special Acts for the construction and maintenance of telegraphs has been printed. It contains as many as 53 sections. Before a company proceeds to place a telegraph over, along, or across a street, not being a street in the metropolis or in a city, or a public road, or to place posts, they are to publish a notice that they have got the consent of the body having the control of the street, and leave notice at the dwelling-houses, and are not to place the telegraph until after 21 days' notice, during which time objections can be made to the Board of Trade. If any person in the employ of a company wilfully or negligently omits or delays to transmit or deliver any message, or by any wilful or negligent act or omission prevents or delays the transmission or delivery of any message, or for improperly divulging the purpose of any message, he may for every such offence be liable to a penalty not exceeding £20. All messages on Her Majesty's service are to have priority, and on the request of the Board of Trade a telegraph is by a company to be placed for the exclusive use of Her Majesty. The act further provides that in case of an emergency telegraphs may be taken possession of for Her Majesty's service by a warrant from the Secretary of State. The warrant is only to be in force one week, but successive warrants may be issued. The Treasury in such case is to pay the company for the loss sustained. A company may bepr oceeded against by the law officers of the Crown on a certificate from the Board of Trade that any provision of the Act has not been complied with or that compliance would be for the public advantage.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c.—*none*.
BOILERS AND FURNACES, 291, 304.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 309.
SHIPS AND BOATS, including their fittings, 299, 319, 334, 339, 341.
CULTIVATION OF THE SOIL, including agricultural implements and machines—*none*.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 310.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 294, 300, 301, 302, 303, 304, 327, 328, 337, 344.
BUILDINGS AND BUILDING MATERIALS, 293, 317, 318, 322, 347.
LIGHTING, HEATING, AND VENTILATING, 298, 307, 308, 315, 335, 338, 351.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 311, 312, 316, 325, 329, 336, 340, 345, 346, 349, 350.
METALS, including apparatus for their manufacture, 292, 296, 313, 342.
CHEMISTRY AND PHOTOGRAPHY, 343, 348.
ELECTRICAL APPARATUS—*none*.
WARFARE, 305, 321, 331, 332.
LETTER-PRESS PRINTING—*none*.
MISCELLANEOUS, 290, 295, 297, 306, 314, 321, 323, 326, 330, 333.

290. W. A. LYTTLE. *Improvements connected with cigar and other tobacco smoking appliances.* Dated January 31, 1863.

This invention is carried out as follows:—1, The inventor prepares a conical or other-shaped tube of paper, tobacco-leaf, or other suitable substance, and fills it with a filtering material. Into one end of this tube he inserts the "butt" or mouth-end of the cigar, attaching it in that position by gumming or otherwise, securely binding it previously to its sale; or he prepares the filtering tube so as to be saleable and portable as a separate article attachable to the cigar by the person about to use it. In the latter case, the inner surface of the end of the tube intended to receive the cigar might be coated with adhesive matter, so that by wetting the end of the cigar it may adhere on insertion. 2, As a filtering material he uses charcoal powder, cotton, wool, flax, hemp, or any other suitable powdered or fibrous material, or simply a roll or strips of a suitable kind of cloth or coarse paper. These materials may be used separately or combined, and may, if desired, be impregnated with perfume, and with chemicals possessing affinity for the empyromatic impurities of the tobacco smoke. *Patent abandoned.*

291. E. B. WILSON. *Improvements in supplying air, gases, steam, or fluids, to iron and other furnaces, and to engines and vessels requiring such supply, and in the apparatus employed therein.* Dated January 31, 1863.

According to this invention it is proposed to effect the supplying of air, gases, steam, or fluids to furnaces, engines, and vessels of all kinds requiring such supply, by the aid of a steam or air jet, the apparatus employed being constructed on somewhat similar principles to the instrument known as "Giffard's injector," but is modified in the manner hereinafter described, so as to enable an accumulative pressure to be obtained. In the improved apparatus the jet-pipe—which may be of annular or other form—is enclosed within an air chamber, which is contracted in front of the nozzle, and provided, if desired, with a regulating plug or apparatus. A branch pipe—which may be in the form of an inverted syphon or otherwise shaped—leads from the side of the air-chamber to the air, gas, steam, or fluid to be injected. On passing a jet of steam or air through the jet-pipe, a supply of air, gas, steam, or fluid, as the case may be, will be drawn through the syphon or other branch pipe into the air-chamber, and injected thence at an accumulated pressure by the jet issuing from the jet-pipe. *Patent abandoned.*

292. F. G. GRICE. *Improvements in machinery for the manufacture of bolts, spikes, rivets, and screw blanks.* Dated February 2, 1863.

We cannot here give the details of this invention. *Patent completed.*

293. E. H. MASSEY. *Improved preparation or compositions for coating and colouring the walls, ceilings, and other parts of buildings.* Dated February 2, 1863.

These compositions are composed of the following ingredients:—Whiting, well-ground and sifted, 3lb.; gum arabic, $\frac{1}{4}$lb.; starch, $\frac{1}{4}$lb.; flour, $\frac{1}{4}$lb.; ground alum, 2 oz.; chloride of lime, $\frac{1}{2}$oz. These substances are well mixed together in a dry state; and in preparing the composition for use cold water is added in sufficient quantity to form a stiff paste, and then boiling water is added to reduce the mass to a proper consistency. *Patent abandoned.*

294. J. GIBSON. *Improvements in looms for weaving.* Dated February 2, 1863.

This invention relates to means of working or operating the healds or heddles in looms for weaving, and the object is to facilitate the changing or converting of "Lancashire" or plain looms into fancy looms. On the ordinary tappet shaft the inventor places a tappet of peculiar form, capable of being readily moved and fixed in position to act upon the ordinary treading levers, in substitution of the ordinary plain treading tappets. He also applies additional levers in connection with the treading levers, so formed and arranged that hooked rods, depending from the ordinary "lambs," which are attached to the healds or heddles take hold thereon. These hooked rods are brought into contact with one or both of the said levers by cards from jacquard or other indicating apparatus, as required, and are withdrawn and held out of contact therewith by springs or weights; or the rods may be brought into contact by the springs or weights, and removed by the indicating apparatus. *Patent abandoned.*

295. A. FORBES. *Improvements in means or apparatus for soldering together parts of vessels formed of tin or tinned plate.* Dated February 2, 1863.

This invention is carried out as follows:—The top and bottom parts, together with the cylindrical or side surfaces of vessels formed of tin or tinned plate, having been shaped to receive one or the other, the patentee, at the part to be united, applies the solder in a ring or other form, together with suitable flux; and then in place of a soldering iron he employs the heat from the flame of gas jets arranged in a ring or other form adapted to the figure of the part of the vessel for the time to be united, such ring or other form being supplied with gas through the stem thereof by a flexible or other suitable pipe from a suitable reservoir, and for the straight part he applies a burner adapted thereto. *Patent completed.*

296. W. C. BARNES. *Improved means or apparatus for shaping, rolling, or compressing metal.* Dated February 2, 1863.

This invention relates to a combination of means, the object of which is to reduce the amount of labour necessary in shaping, rolling, or compressing metal into various forms. For this purpose there is a series of plates or discs or sections of rolls, into each of which the figures or discs for producing the required article are formed or fixed, and such plates, discs, or sections are so arranged or applied upon the shafts or spindles that they not only become top and bottom dies, but partake of the form of a pair of rollers or rolls, that portion of each where their operation is not required being of a diameter suitably less in proportion to the figure of the article to be produced. These rolls or rotary dies are caused to work simultaneously at the same surface speed, and towards the position for holding the article or piece of metal to be operated upon. The bar or other form of metal to be operated upon is placed between the rolls to the extent desired, and whilst the smaller diameters of such rolls are opposite each other; then, so soon as the operating parts or dies come into operation, the action is to repel the bar whilst giving form to it, by pushing it back in their rotary course towards the workman or starting-point. The position of the metal to be operated upon is adjustable by stops, and the carriage or holder in which the metal or article is placed is composed of a compound slide; and on the revolution of the slides, as that part comes round for giving form, the squeezing or compression takes place, and the metal is formed into the figure of the operating parts, as a bayonet or other article, which, being forced back in its proper form, the machine is ready for the insertion of other metal to be similarly operated upon. *Patent completed.*

297. R. H. FRITH. *Improvements in the manufacture of paper.* Dated February 2, 1863.

This invention consists in the reduction of peat or turf bog into a pulp, which is then bleached by the application of chloride of lime, or by any other chemical bleaching process, and afterwards manufactured into paper in the ordinary manner. *Patent abandoned.*

298. E. B. WILSON. *Improvements in the manufacture of gas.* Dated February 2, 1863.

This invention consists in the manufacture of gas from oil, by placing in a suitable vessel containing the oil a coil of piping, pipe, or pipes through which the inventor passes hot water, air, or steam at such a temperature as shall generate gas from the oil contained therein, which vessel may be large enough to be but partially filled with oil, leaving the remaining space for gas; or a separate receiver with purifier may be connected. *Patent abandoned.*

299. W. CLARK. *Improvements in armour plated or other ships.* Dated February 2, 1863.

According to this invention, the patentee builds war ships having the main body or continuous part of the hull but little above the load line, say some 3 or 4 ft., or it may be only to the load line; so far the mould of the ship is much as in ordinary. From this level he carries up the hull of the ship in sections, say, in two sections or parts (for a ship 400 ft. in length) of about 100 ft. in length, the one part commencing, say, some 30 or 40 ft. from the stem, and the other about 20 ft. from the stern. These parts he builds up to the height necessary for a man, and sheaths or coats them entirely with armour plates. The fore part of these sections or parts he prefers of a buff bow shape, while the after parts may be of a semicircular or other form. The part of the lower body unoccupied by these sections or structures will be a kind of a deck which he forms and covers over with strong iron plates to give the necessary strength to the hull, and to resist the force of exploded shells, or the graze of shot, to which alone it would be subject being nearly or quite horizontal. In building these vessels he carries a light upper deck over the entire area of the ship, which deck is carried between the raised parts of the hull on girders stretched from the one to the other, and if necessary supported by pillars from the exposed plated deck below. He has mentioned the raised parts of the hull as being two in number, but three or other number may be adapted. In the arrangement before described he also carries up a small section immediately behind the stem, but which need not be covered with armour plates; it would serve as a communication to the forecastle, and as a support for the fore part of the upper deck; or the deck may terminate at the armour-protected part both fore and aft. Besides covering the raised parts of the hull with armour plates, say, to the required depth of 5 ft. below the water line and over the whole of the lower part of the hull rising above the water which may be to the extent of 2, 3, 4 or even 5 ft., it may be necessary that the main and full length part of the hull requires to be 5 ft. above the load line to give the ship the necessary boyancy or liveliness, but which may not be the case as the raised parts of the hull are intended to and will give great boyancy if depressed in the water by the pitching and rolling of the vessel, and may produce all the necessary buoyancy, even although the full length and low parts of the hull be only at a level with the water line; it may even be advisable to sink that part of the hull below the surface of the water by admitting water ballast or otherwise before going into action. In the latter case the armour plating might be dispensed with at the low parts of the hull, while if sunk by the admission of water ballast only to the level of the water line, a depth of 5 ft. of armour plating would be sufficient. *Patent completed.*

300. C. and G. L. SMITHIES. *Certain improvements in preparing and bleaching "Rheea" and other fibrous materials and fibres, which improvements are also applicable to bleaching yarns or piece goods.* Dated February 3, 1863.

The fibres or fibrous materials after having been properly cleansed and opened by scutching machinery are placed in trays, skips, or baskets made of galvanized iron wire, or other suitable material, and provided with handles to facilitate their being moved about and raised from or lowered into cisterns or vats by cranes or other suitable appliances. The trays or baskets with their contents are now immersed in soft cold water contained in vats or cisterns, having removable grids at the bottom to admit of the separation of any deposit or sedimentary matter, and the fibre is allowed to soak therein for a space of 24 hours, at the end of which time the water is to be withdrawn. The cisterns or vats are then refilled with clean soft water, which with the fibrous materials or fibres is maintained at a temperature of from 90 deg. to 100 deg. Fahr. for a space of 24 hours, by passing steam into the cistern or vats by means of any convenient apparatus connected therewith. The fibrous materials are then removed and passed between grooved or fluted rollers under a suitable pressure to express the water and various impurities dissolved by the foregoing treatment, and also to break and soften the fibre, and they are then treated with vegetable, animal, or mineral oils, if necessary, and replaced in trays or baskets constructed in the manner hereinbefore described, but provided in this case with partitions or divisions for keeping the fibres straight, and preventing matting; the baskets or trays are then placed in an air-tight chamber or vat having a removable grid or perforated false bottom. After the air has been exhausted by any ordinary means from the chamber or vat, the bleaching liquor—which consists of a solution of caustic soda or other caustic alkali—is admitted at the bottom and forced up through the fibrous materials until the said vat or chamber is filled, and the materials are to remain thus saturated for about 12 hours at a temperature of 120 deg. to 212 deg. Fahr., according to the nature of the fibrous materials acted upon, and the purpose for which they are intended. The air is then to be admitted into the vat or chamber, and the waste liquor drawn off, when the fibrous materials are subjected to the action of the solution of soap and soda, or caustic soda, or other alkali, until the colouring matter has been removed. *Patent completed.*

301. T. RAWORTH. *Improvements in looms for weaving ribbons, elastic webbing, and other narrow fabrics.* Dated February 3, 1863.

The patentee claims driving two or more shuttles or sets of shuttles by driving racks communicating motion by wheels or pinions mounted on concentric spindles or axes, in the manner and for the purposes described. *Patent completed.*

302. G. HOLCROFT. *Improvements in preparing cotton for the operations of spinning and weaving.* Dated February 3, 1863.

This invention consists in subjecting the lap of cotton produced by the blower, or the slivers produced on the carding engine and drawing frame, or the rovings produced on the slubbing, intermediate, and roving frames, or the yarn when spun on the mule or throstle, or any of them, to the action of steam, for the purpose of rendering the cotton pliable, and in a better condition for being worked than it is when operated upon in the usual manner. *Patent abandoned.*

303. S. ODDY and E. OLDFIELD. *Certain improvements in carding engines.* Dated February 3, 1863.

This invention consists in applying two doffers to the main cylinder of the carding engine, and in applying a fancy roller or revolving brush between the two doffers. The object of the invention is to deposit on the second doffer the fibres that have been carried by the main cylinder beyond the first doffer. When this improved carding engine is at work, the greatest part of the fibres are deposited on the first doffer, and the remaining fibres being acted upon by the fancy roller or brush, are raised or loosened on the main cylinder and deposited on the second doffer. Both the doffers are stripped by combs or other stripping instruments. *Patent abandoned.*

304. J. FLETCHER and H. BOWER. *An improved injector or apparatus for feeding boilers with water.* Dated February 3, 1863.

This injector consists of one pipe coiled spirally around another pipe, or of a pipe having a straight passage through its centre, and a crust sufficiently thick to admit of a spiral passage being formed therein around the central passage. The spiral passage opens at one end into a water-supply chamber, and the other into a discharge or injection chamber, which is to be attached to the ordinary feed pipe of a boiler. The straight passage is connected at the water chamber end to the pipe which opens to the steam chamber

of the boiler, and the other end terminates in the discharge or injection chamber at a point near to, and concentrically with, the outlet or orifice of the feed pipe. The apparatus is provided with taps or valves for regulating the flow of steam and water. *Patent completed.*

305. A. T. BLAKELY and J. VAVASSEUR. *Improvements in projectiles for ordnance.* Dated February 3, 1863.

These inventions consist in forming projectiles with grooves on the body and at the rear end thereof for receiving lead or other soft metal. The patentees prefer to form these grooves at an angle to the axis of the projectiles, and in the reverse direction to that of the rifling of the gun in which they are to be used; but the grooves may run parallel to the axis, and may be more or less long and deep, according to requirements. When the projectile is ready for use, there are alternate layers or strips of lead or other soft metal and iron or other metal of which the projectile is formed, round the circumference thereof, the iron or other metal thus protecting the lead or soft metal from injury. *Patent completed.*

306. T. L. JACOBS. *Improved mode of, and apparatus for, cleaning casks.* Dated February 3, 1863.

This invention consists in filling, or nearly filling the casks with water, and then introducing steam or air under pressure into the water, so that the latter may be put in a state of ebullition. *Patent completed.*

307. W. G. VALENTIN and F. LEVICK. *Improvements in generating combustible gases, and in the apparatus employed therefor.* Dated February 3, 1863.

This invention relates more particularly to the generation of gases for heating purposes, such as heating, puddling, and other reverberatory furnaces, and evaporating liquids, heating boilers, and generating steam, and for any other purposes in which the combustion of such gases may be serviceable. The object of the invention is to produce, in an expeditious and economical manner, large volumes of combustible gases, consisting chiefly of hydrogen and carbonic oxide, which can be obtained by the combustion of coal, wood, peat, tar, or other carbonaceous substances, by means of atmospheric air and steam. The invention cannot be described without reference to the drawings. *Patent completed.*

308. W. E. NEWTON. *Improvements in reflectors.* (A communication.) Dated February 3, 1863.

This invention consists in the employment of a system of glass plates, which serve to conduct or direct the rays of light. These plates, which may be termed refractors or projectors, which is a more technical term than reflectors, are placed vertically above a light, and present, on the one hand, a row of prisms superposed with horizontal bases, and, on the other hand, a row of prisms or flutings in a vertical direction. The light which passes through this plate, therefore, undergoes two changes of direction occasioned by the refractions produced by the inclined faces of the glass. *Patent completed.*

309. G. HARTON. *Improvements in wood paving.* Dated February 4, 1863.

This invention consists in placing a metal ring or hoop round the wood block, and laying down the same in the ordinary manner in wood pavements. The ring or hoop would be usually fixed round the upper end of the block, either by driving it upon a reduced end, or upon a shoulder prepared for that purpose; or the ring or hoop may be fixed on the block by heating the same, and fitting it on while hot. The blocks would be either square, circular, lozenge shape, hexagonal, or other form usually applied to wood pavements, and the ring or hoops to be fitted on the same would be of similar form. The upper and lower edge of the ring or hoop would generally be level or straight, but the inventor would sometimes indent the same on the upper edge. The rings or hoops would be usually made of iron or galvanized iron, but in some cases they would be of copper or brass. *Patent abandoned.*

310. J. MELLOR. *Improvements in apparatus to be used in distilling, subliming, and drying.* Dated February 4, 1863.

This invention consists in applying to vessels or retorts in which the various processes of distilling, sublimating, or drying are performed, a series of scrapers, having an angular, semicircular, or other suitable form, to which a reciprocating motion is given by cranks or other equivalent agents, thereby causing the vegetable, animal, or mineral substances under operation to be continually turning over, and at the same time moving forward. *Patent completed.*

311. T. E. TALLENT. *Improvements in the manufacture of leather, and in machinery for that purpose.* Dated February 4, 1863.

This invention is carried out as follows:—Upon two side frames is placed a table on which the hide or leather travels, and upon the same frames, and immediately above, is mounted a shaft on which is fixed a number of knives or scrapers, so arranged as to give a continual pressure upon the hide or leather; and to these knives is given a circular motion, so that the knives being driven at a proper speed by means of suitable pulleys and belts have action upon the hides or leather under them, and by this means the hide or leather is gradually carried forward, and thus the operation is completed. *Patent abandoned.*

312. T. BRADFORD. *Improvements in machinery or apparatus for washing, wringing, and mangling clothes or other textile fabrics.* Dated February 4, 1863.

This invention consists of a method of utilizing atmospheric air or steam in the process of washing, by a suitable arrangement and formation of vessel or washing compartment, and a novel construction of floating rubber or dash for the collection of atmospheric air or steam, and its forcible distribution through the washing ley and fibre, simultaneously with a rubbing action thereon, and which dash the patentee works upon one or more suitable inclines, one or both ends of which dash (as may be found desirable in its application either for hand or steam power) to be made in the form of, and to act alternately, as a suction valve or float and air piston, the centre being of metal, wood, or other open work for rubbing purposes, and for the admission and emission of air, steam, and water, as alternately drawn in, and expelled by, the other part of the dash. In that part of the single and double dash which works at the top of the incline, he proposes to fix a weighted roller to act as a rolling or sliding anchor or working centre for the float end, the floating power of which end he also proposes to assist by a suspensory elastic spring or band, or other convenient and suitable means. For wringing and mangling he introduces an improved combination and application of spring lever and spring, which spring lever and spring he makes of spring steel or any other suitable material, so that, while the maximum of pressure is attainable by the fulcrum of such levers, any required maximum is obtained by the ends of the lever coming into contact with any fixed resistance, or more particularly and more effectively when the end of such lever comes into contact with spring bars or plates, or a fixed buffer of india rubber, or a spiral spring, or any other similar combination of spring and lever. For mangling, the application of this form or means of pressure is particularly desirable, for which he adopts a combination of wood and cylindrical metal roller alternately for the portable roller, and a cylindrical metal roller. *Patent completed.*

313. G. HASELTINE. *Improvements in the mode of uniting metallic surfaces.* (A communication.) Dated February 4, 1863.

The patentee claims uniting thin and thick metallic sheets or plates by means of metallic rivets combined with simple apertures in the thin facing sheets, and enteriorly enlarged cavities in the thicker underlying plates of metal, substantially in the manner, and for the purpose set forth. When the invention is used for the purpose of protecting with a facing of copper the hulls of iron-plated vessels, or other iron surfaces exposed to the action of water or other liquid, the patentee claims the use of a thin layer of india rubber, gutta percha, or other insulating substance or material, when interposed and combined with the outer copper facing and the iron surface beneath, the same being rivetted and secured substantially as set forth. *Patent completed.*

314. G. T. BOUSFIELD. *Improvements in postage, revenue, and other stamps, and in apparatus for post-marking and cancelling postage and other stamps.* (A communication.) Dated February 4, 1863.

The nature of the first part of this invention consists in providing a postage, revenue, or other stamp, with perforations across the same, so that it may readily be separated into two parts, and in covering one part of such stamp below or above the said perforations with glue or other adhesive matter, while the remaining part of such stamp shall remain without any adhesive substance whatever, so that one part of the said stamp shall adhere to the letter, envelope, or packet on which the same may by law be required or used for the payment of postage, tax, or otherwise, while the remaining part shall not so adhere, but be free therefrom, whereby that part may be separated from the other part remaining upon, and adhering by means aforesaid to the letter, envelope, or packet, and thereby cancel the said stamp, and thus and thereby prevent a reuse for any purpose whatever; by this means also the labour and expense of cancelling such stamps by any instrument with ink is saved. The nature of the second part of the invention consists in so constructing apparatus for cancelling stamps that the same shall cut the postage stamp or any stamp similar thereto without injury to the contents of the envelope or packet enclosed therein, and at the same time cause a heavy circular mark upon the inside and one upon the outside of that part of the stamp or letter frank cancelled by the cutting device, so that the said postage stamp or letter frank shall readily show cancellation in ink, and when removed from the letter or packet on which the same may have been cancelled it shall be reduced to parts or pieces, whereby a second use of the said stamp or frank is thus prevented, though it may have been previously cleaned by a chemical or other process. It also consists in the employment and combination of a cancelling stamp with a cutting and inking device thereon, with a post-marking or dating stamp, so that the cancelling of the letter-frank and the post-marking on the envelope or packet shall be effectually done at the same operation. *Patent completed.*

315. J. J. HAYS. *An improved hot air stove where peat charcoal is the fuel employed, and for the method of using peat charcoal or other suitable fuel, in connection with the said stove, or other stoves, for the purpose of purifying or filtering the gaseous products of combustion.* Dated February 4, 1863.

This invention is not described apart from the drawings. *Patent completed.*

316. L. J. H. MARVILLE. *A covering for the ears made of india rubber, gutta percha, or other materials.* Dated February 4, 1863.

The apparatus the subject of this invention is usually made of india rubber, and is moulded externally to the external shape of the ear. The size of the auricle of the ear varies considerably with different individuals, as well as its shape, which is very irregular, but which may, nevertheless, be generally described as an oval, the greater diameter of which would be vertical, and the larger end turned upwards, curved in various ways, pressed from the outside inwards. This oval extends to the adjoining parts. These coverings for the ear present all the projections and hollows of the external face of the ear, which are from top to bottom. *Patent completed.*

317. Z. M. PARKES. *An improvement in iron and other metal bonds in use for building.* Dated February 4, 1863.

This invention consists of a band or strip of iron, or other metal, with transverse teeth, ridges, ribs, or projections pressed out of the solid, and so raised at intervals on each side of the strip or band for or on the whole width thereof. These projections are intended to be laid in the cement or mortar, or between the courses, or in the joints or interstices of the bricks, stones, or building materials, so that the bond thus held prevents the materials from giving or slipping out of place. *Patent abandoned.*

318. W. T. WESTON. *An improved spring catch or fastening applicable to windows and other useful purposes.* Dated February 4, 1863.

This invention is not described apart from the drawings. *Patent completed.*

319. B. RUSS. *Improvements in the construction of iron ships or vessels, and of armour applicable thereto.* Dated February 4, 1863.

This invention, so far as it relates to armour plates, consists in constructing such plates of iron and steel, in two or four distinct parts, which may be put together as follows:—If made of two parts, the first portion of the armour plate is the "back," and is composed of forged or rolled iron of suitable length, width, and thickness. The second portion is the steel face, and is composed of cast or wrought steel, or Bessemer steel of suitable length, width, and substance. The steel face may be laid on the iron "back," and the two plates may be then subjected to the heat of a blast furnace, or otherwise, till heated to the requisite degree for welding. The two portions may then be hammered or rolled into one solid armour plate. If made of four portions, the patentee adds to the first series of two portions already described, a second series of two portions of like materials, in the same order as before, and heats and welds as before described. The improvements in the construction of iron ships or vessels, as described in the specification of this invention, are too diffuse to be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

320. C. and D. FAULKNER, J. FAIRLEY, and W. C. STIFF. *Improvements in the manufacture of gun barrels.* Dated February 4, 1863.

The patentee claims converting or carbonizing partially-formed tubes of iron or steel for gun barrels, technically called "moulds," whether the same be formed by coiling, welding, drilling, punching, or casting, and then elongating or finishing the same in the ordinary way now commonly pursued. *Patent completed.*

321. J. A. MANNING. *Improvements in the treatment of nightsoil and other waste products, and for the manufacture of manure therefrom.* Dated February 4, 1863.

The main feature of this invention consists in treating nightsoil with sulphuric acid, in the manner described in the specification. *Patent completed.*

322. W. STOKES. *Improvements in the construction of window sashes whereby the same are rendered more weather-proof, and secure against draughts and burglars, and permit the outside to be cleaned with the facility of the inside.* Dated February 4, 1863.

The invention consists in making the sash proper a little less than the window frame between the beads, and occupying the difference on each side with additional stiles, to which the cords are to be attached in the ordinary way for counterpoising the weight of the sash; and these outer stiles are attached at or near the bottom or lower inner edge of the sash by suitable hinge joints, which permit the sashes, when liberated by the fastener, to fall inward, say, into a horizontal or other convenient slanting position, thereby rendering it as convenient to clean or renew the glass in case of breakage as if the sash were removed from the window frame altogether. On the edges of the sash and corresponding edges of the outer or hanging stiles, the inventor applies metal strips that overlap each other, thereby rendering the joints entirely weather-tight, and secure from draughts; and this same principle he applies to the outside of the top rail of the lower sash, and the inside of the bottom rail of the top sash; by which means the over-lapping of the metallic strips not only excludes the draughts, but also prevents the insertion of any knife-blade or other contrivance to undo the sash fastener, which may be of any ordinary construction. To prevent the sashes falling forward into the room from the pressure of the wind or otherwise should the fastener be left undone, and the lower sash slightly elevated, he purposes using spring or other suitable catches or detents that are brought into action for uniting the sash with the hanging stiles, so that, when the sash is in position, the outer slide shall be united to it at the top, and either of the lower or top sash, although it is not essential to the top sash, as metallic pins may be secured to the top rail fitting metallic sockets correspondingly applied to the top of the sash frame, so that as the top sash is slidden up, the pins will enter the metal sockets, and thereby hold it in position. *Patent abandoned.*

323. W. T. MABLEY and W. T. CHEETHAM. *Improvements in blowing organs and other such musical instruments, parts of which improvements are also applicable to obtaining motive power for other purposes.* Dated February 5, 1863.

This invention relates—1, to apparatus to be used as a substitute for the ordinary bellows used in blowing organs and similar musical instruments. For this purpose the inventors employ a flexible bag or tube disposed in a cylindrical form, and cause it to revolve against a roller, or a roller to revolve thereon, so that the air as it is drawn in at one end is expelled at the other. Another part of the invention relates to a method of giving motion to bellows of organs, applicable also to other cases in which comparatively small motive powers are required. For this purpose they employ a wheel having vanes or teeth upon its circumference, and on these they cause water to be injected in such a condition as to form a jet, and acting therefore by impulsive force, the said wheel being mounted so as to revolve free of the fluid. At the backs of the vanes or teeth they leave openings so as to allow the water to escape readily. For the supply water they propose when available to use the ordinary public service pipes. In order to regulate or govern the motive power, they close or partially close the orifice of the jet, and cause a conical spindle or wedge-formed piece to be drawn backward or forward, so as to contract or enlarge the opening. *Patent abandoned.*

324. J. GILL and J. PARKIN. *Improvements in apparatus for polishing yarn, twine, threads, and other similar materials.* Dated February 5, 1863.

This invention consists in the combination and arrangement of the polishing and conducting rollers with and in relation to the ordinary heated cylinder, whereby the yarn, twine, thread, or other material is polished on both sides, and protected from the ordinary liability to breakage. For this purpose the ordinary roller covered with hair, cocoanut fibre, or other suitable material, is arranged so as to polish the outer surface in the ordinary manner. The yarn, twine, thread, or other material is caused to pass from this roller over the ordinary tin or wooden guiding roller, thence over a smooth conducting roller, whence it passes to a second polishing roller with a roughened surface so placed as to act upon the inner surface of the yarn, twine, thread, or other material, which thus becomes polished on both sides. By this arrangement of the several rollers the strain on the yarn, twine, thread, or material thus becomes distributed in such a manner as to prevent any under pressure on any particular part thereof. *Patent completed.*

325. W. BETTS. *Improvements in apparatus for applying metallic capsules to bottles.* Dated February 5, 1863.

This invention relates to a peculiar construction and arrangement of apparatus for applying metallic capsules to bottles, whereby greater economy and simplicity of construction are obtained, with increased efficiency of action. According to this invention, the compressing loop—which is made by preference of what is commonly known as "catgut"—is always maintained ready formed, and in an open state fit to receive the neck of the bottle, in place of requiring to be made by hand at every fresh operation. One end of the gut is secured to the side of a metal plate, having a semicircular or other suitably formed notch made therein for the reception of the bottle neck. The gut then passes, in the form of an open loop, under and in front of the bottom of the notch, and over the top, and finally ascends to a connecting rod secured to a treadle, which works on fixed centres in the back portion of the capsuling stool, or in any convenient part of a workbench. The lower portion of the loop is held down in its place, just below the edge of the notch in the plate, by a wire connected to a weight, or to an india-rubber or other spring, and the whole is carried by an upright post, fixed either to the front of the stool or to a workbench or table. The treadle having been depressed in order to compress the loop of gut round the capsule on the neck of the bottle, is raised again on being released, so as to open the loop and liberate the bottle by a spring, the inherent spring in the gut itself serving to maintain the loop open when not acted upon by the treadle. A check or projecting piece is fitted to or formed on one side of the notch in the plate, for the purpose of retaining the loop in its place close against the metal plate. *Patent completed.*

326. H. DIRCKS and J. H. PEPPER. *Improvements in apparatus to be used in the exhibition of dramatic and other like performances.* Dated February 5, 1863.

An extension of time for the completion of this patent having been petitioned for, the documents relating to the invention cannot at present be seen.

327. E. INGHAM. *An improved apparatus for, and means of, dyeing the wool in the sliver from which "mixture yarns" may be drawn.* Dated February 5, 1863.

Heretofore, what are termed "mixture yarns" have been produced by drawing from two slivers, the one plain or undyed, and the other of any desirable colour. This improvement consists in dyeing slivers in such a manner that "mixture yarns" may be drawn from a single sliver. *Patent abandoned.*

328. R. A. BROOMAN. *Improvements in machinery for supplying and spreading wool and other filamentous materials on belts, tables, and other surfaces to be afterwards carded and otherwise acted on.* (A communication.) Dated February 5, 1863.

This invention is not described apart from the drawings. *Patent completed.*

329. J. PATERSON. *Improvements in buckle and hook fastenings.* Dated February 5, 1863.

This invention consists of two parts, which may be used together or separately. The first is in the form of a buckle, and the invention therein consists in forming the buckle all in one piece, as hereafter stated. The teeth or prongs of the buckle are formed by slotting out parts from the buckle plate, and by leaving parts projecting beyond portions removed from between these projections. A bar is left below and at a slight distance from the projecting parts in prongs, and below this bar a piece is slotted out to allow passage to the material to which the fastening is to be applied. The upper part of the plate above the bar is bent slightly backward. The hook fastening, which may be formed in the buckle flap—or, as before stated, may be used separately—consists of the end of the flap (or end of a plate) turned over, and with the joint made to project and bend slightly downward; a tongue stamped or cut out of the flap or plate is then shaped and brought over the joint and end of the turned-up hook, whereby a safety spring hook is produced. *Patent abandoned.*

330. R. A. BROOMAN. *Improvements in apparatus for tuning pianofortes.* (A communication). Dated February 5, 1863.

The object of this invention is to facilitate the tuning of pianofortes. In order to tune two strings or make two strings agree, they must be of the same nature and possess homogeneity of sound; and to obtain this result it is necessary—1, that they be made to vibrate simultaneously; 2, that the vibrations run together in the same sounding board; 3, that they follow the same circumvolutions, and that they are reverberated by the same surfaces. The apparatus which forms the subject of the present invention fulfils these conditions. The inventor arranges a sonometric string parallel to the strings of which it is the type; it rests on the same bridge and acts on the same sounding board. The longest string in the pianoforte is supported on a moveable nut, guided in a longitudinal direction by a register for indicating externally the sound the type of which is required. The string, lengthened or shortened according to the proportions of the sonometer, by means of an additional pedal, gives successively the typical sound in the score to be produced. Thus, to tune an instrument, the typical string and the string to be tuned are simultaneously struck, one with the foot (because the pedal moves a hammer), the other with the left hand, while the right hand acts on the peg of the second string to raise or lower it in unison with the first; the tuner proceeds with these strings as if they belonged to the same key. This tuning apparatus may be fitted inside or outside the pianoforte. *Patent completed.*

331. B. F. BATES. *Improvements in cannon, and in projectiles to be used therewith.* (A communication.) Dated February 6, 1863.

In constructing cannon according to this invention, the inventor forms a hole through the breech, and this hole is smaller than the bore, and is parallel and concentric with it. Each projectile is provided with a long rod or bar, which, in loading the cannon, is passed through the hole in its breech. At the front end of the rod there is an enlargement or head, which, however, is smaller than the bore; this head may be solid, or it may be formed into a shell, and behind this enlargement is placed a loose disc, which fits the bore accurately. The periphery of this disc may, if desired, be formed of soft metal, and may also have lubricating material combined with it. The rod at the rear end of the projectile is, by preference, polygonal in section, with each of the sides winding spirally around the rod from end to end of its length, as though the rod were twisted. The hole in the breech end of the cannon is formed to fit and correspond with the bar, so that when the piece is fired, the projectile, in addition to being propelled forward, will, at the same time, be caused to revolve on its axis. The loose disc behind the head of the projectile, by preference, does not rotate with the projectile, but the rod of a projectile turns in a hole in the disc. As soon as the projectile leaves the gun, the resistance of the gun will cause the disc to slip off the bar at its rear end; or the disc may be made to separate into two or more pieces as soon as it leaves the gun. If desired, the hole through the breech end of the gun may be closed as soon as the rear end of the projectile passes out of it, by means of a sliding piece pressed forward for that purpose by a spring. The hole in the breech end of the gun may be provided with a close-fitting plug; the gun can then either be used to propel a shot, such as above described, or, when the plug is fixed in the hole, the gun may be used as an ordinary smooth-bore gun. *Patent completed.*

332. A. HANTZMANN and T. A. ROCHASSEN. *An improved boring bench for gun barrels.* (A communication.) Dated February 6, 1863.

Provisional protection has not been granted for this invention.

333. T. BLAKELY and B. MEAKES. *An improved lead and pencil sharpener.* Dated February 6, 1863.

This invention consists of a piece of hard wood with a hole drilled into one side, such hole being conical at one end, and parllel at the other end; opposite the conical end there is a recess cut in the wood to admit of a knife, which is made fast in this recess by means of a screw; there is a slot hole in the knife by which arrangement the latter can be regulated to cut with the greatest accuracy, and can be taken out, sharpened, and replaced at convenience. *Patent abandoned.*

334. A. JOHNSTON. *Improvements in the propulsion of vessels.* Dated February 6, 1863.

This invention relates to a method or system of propelling vessels by means of an improved propeller, consisting of one or more pieces of submerged cylinders, fitted with pistons of the form hereinafter more particularly described. In carrying out the invention, the patentee makes use of one or more pairs of these cylinders and their pistons, and he places them water-tight below the light-load water-line in the stern or other suitable part of the ship. The cylinders and their pistons are used in pairs, each pair of pistons by the piston rods being connected to each other by means of a rocking beam or beams placed inside the ship. By reason of being connected to this rocking beam the pistons are balanced and kept in their relative positions. The propelling pistons (which he calls the water pistons, to distinguish them from the steam pistons) are formed with projections or noses which extend from the piston head and packing of the water pistons towards the mouth or open end of the water cylinders. These projections or noses must be made of a size sufficient to fill up the whole area of the water cylinders when the pistons are drawn back, leaving just space enough to avoid friction or rubbing against the inner surfaces of the said water cylinders, and the ends of the said projections should be slightly dished or hollowed out so as to enable them to take a better hold of the water. The projections may be made of cast iron or other suitable material, and should be made hollow, but they must be made of such weight as to be equal or thereabouts to the weight of water which they displace, so that, when the pistons are extended to the full length of the stroke, there may be no strain on the water cylinders. *Patent completed.*

335. G. STEVENS. *Improvements in means or apparatus for effecting a regular supply of air or aeriform fluids for various purposes.* Dated February 6, 1863.

This invention is carried into effect as follows:—Within a suitable outer chamber the inventor applies an internal vessel, which is affixed to an axis carried by the outer chamber, and is formed into one or more spiral chambers or compartments, somewhat as the thread or the threads of a screw, with inlet and outlet passages. The outer chamber is partly filled with water or other fluid, which also partly fills the chamber of the internal vessel, and this outer chamber is also provided with inlet and outlet passages, the latter passing to within the inner vessel. Motion being given to the internal vessel by a pulley and weighted cord or band, or by suitable wheelwork, air will flow in by the inlet passages, and be conducted along the internal screw-like chamber or chambers to the outlet passage, and thence by suitable pipes or conduits it may be conducted in a uniform stream for various purposes, such as for the supply of atmospheric air to the photogenic gas light, or for supplying air to apartments and other places. The speed and consequent pressure of the current may be varied by adjustment of the power employed to give motion to the internal vessel. *Patent abandoned.*

336. A. CLARK. *Improvements in knife-cleaning apparatus.* Dated February 6, 1863.

This invention consists of a rectangular kind of box, or it may be of other form, of a length rather more than the longest knife-blade to be cleaned, and a breadth of some 4 in. or 5 in. Inside the bottom of the box the inventor applies a surface of leather, or it may be in strips across it, on which surface the side of the knife being cleaned lies: a slit is formed in the end of the box at which the blade is introduced. Within the outer case is fitted another box to slide up and down freely; it is of much less depth than the outer case, and it is pressed down on the latter surface by springs above or abutting on, and thrusting from the lid of the case. The face of the inner box opposed to the leather surface before mentioned has also strips of leather placed and fixed across it, and, being pressed downward, exerts a pressure on the knife-blade placed between the leather surface, which will be quickly cleaned by a motion of thrusting in and withdrawing the blade being communicated to it by hand. In this way two knives may be cleaned simultaneously, one in each hand of the operator. Brick-dust or other powder is introduced at the top of the case in the centre, which communicates with a small trunk or channel leading into the inner box, which may be more or less filled with it, and which finds access to the cleaning surfaces through holes in the bottom between the strips or surfaces of leather. *Patent abandoned.*

337. R. A. BROOMAN. *Improvements in carding engines, whereby slivers are formed into threads ready for spinning.* (A communication.) Dated February 6, 1863.

The object of this invention is to cause the slivers to leave the card fine enough to be spun directly and without any further drawing than is necessary to give the thread the desired tension during the torsion, as hereafter described. The invention is based upon the arrangement of the supply cylinder, the sliver guides, the great speed and short stroke of the detaching comb, and especially on the combination of the rapidly-rotating funnels, and of a friction roller (*rota frotteur*). Without this triple combination of the comb, of the funnels, and of the friction roller, it is believed that a sliver cannot be made to issue from a carding engine in a state of fine thread like that produced by this invention. The arrangement of the slivers and of the partitions which separate them at short intervals on the large drum, so that the number of the slivers on the drum of the carding engine may be increased, also forms part of this invention. *Patent completed.*

338. W. ROBINS. *Improvements in the construction of fire-lighters or faggots.* Dated February 6, 1863.

When manufacturing what is known as the "wheel" form of fire-lighter, the inventor proposes to make all the radial spokes of short pieces of split wood, and to connect these pieces together at the centre by inserting a key into a saw-cut made in the abutting inner ends of the spokes. The periphery he forms as usual, and inserts a tuft of bass or shavings in the centre to facilitate the ignition of the faggot. When forming rectangular faggots or fire-lighters, instead of using long pieces arranged parallel to each other, he uses short pieces of split wood for the inner bars, runs a saw-cut through their inner abutting ends, and connects them together by a long key, the ends of which butt against the side pieces. Similarly, he runs a saw-cut through the outer ends of all the pieces, and ties them together, as heretofore, by longitudinal keys. The inner key first mentioned serves to increase the strength of the structure, and the disposition of the keys admits of the parallel bars of one faggot packing in the spaces of an adjoining faggot. *Patent abandoned.*

339. J. PRICE. *Improvements in signal lanterns suitable for being used in open boats.* Dated February 6, 1863.

The peculiarity of this invention consists in combining the parts of a lantern in such manner that at one time (that is when a boat is at anchor), the lantern may be capable of showing a white or bright light all round, and then for a time (that is when the boat is in motion) the part of the lantern which is glazed all round with white glass may be covered interiorly or exteriorly with a screen or screens, consisting of three parts or divisions, one part or division being opaque, one part or division being composed of red glass, and the third part or division being composed of green glass, so that the light in the lantern will be only thrown forwards through the red and green screens, whilst the light will be stopped from being seen at the third or back side of the lantern. *Patent completed.*

340. A. D. TIVNANN. *Improvements in holster boxes for screws or pins to work in, and in the manufacture thereof.* Dated February 6, 1863.

In carrying out this invention the inventor uses boxes of brass, gun metal, or copper for the iron or hard metal screws or pins to work in, and he makes such boxes by casting the same on to the screws or screwed pins intended to work in these same with the threads thereon. The patterns of the outside shape of these boxes is prepared in the usual manner. The object of the invention is to save wear and tear, and produce an article which shall, when useless for its original purpose, be valuable as old metal. *Patent abandoned.*

341. A. ELLISSEN. *An improved method of treating sheeting and plates of iron to be used in shipbuilding and marine constructions for protection against marine animals and marine plants.* Dated February 6, 1863.

In carrying out this invention, the inventor treats iron sheeting or plate with cyanide of potassium or potash, or other material of equivalent effect, for the purposes of rendering the same useful for shipbuilding purposes and marine constructions, thereby protecting such ships

constructions against marine animals and marine plants. Patent abandoned.

342. J. CAMERON. *Improvements in the manufacture of iron and alloys of iron.* Dated February 7, 1863.

The patentee claims the manufacture of iron by mixing with the iron ore the quantity of fuel and flux necessary for its proper reduction, grinding, and intimately mixing these materials and forming them into blocks which are then smelted. He also claims the production of alloys of iron by the employment of ores of two or more metals in the making of the blocks, the process being otherwise similar to that above claimed for the manufacture of iron. *Patent completed.*

343. J. SIRON. *A new medicinal preparation for internal and external application.* Dated February 7, 1863.

This new medicinal preparation is composed of the following plants, culled when at maturity, and in possession of all their aroma, both flower and leaf being used, unless one or other be specially indicated:—1, Mentha viridis; 2, Artemisia foliis pinnatisidis (vul. mugwort); 3, Hypericum perforatum; 4, Lavendula spicata; 5, Achillea millefolium; 6, Hypericum frigademonum; 7, Plantago arenaria; 8, Hissopus officinale; 9, Thymus serpillum; 10, Thymus vulgaris; 11, Teucrium foliis cordatis undulatis; 12, Artemisia absinthium; 13, Salvia officinale; 14, Fœniculum officinale; 15, Anettrum fœniculum; 16, Apium Petrosilinum; 17, Borrago officinale; 18, Lilium candidum; 19, Flores Lambuca; 20, Spirea almaria; 21, Fores tilia parviflorœ; 22, Flores rosarum centifoliarum; 23, Flores citri medicœ; 24, Rosmarinus officinale; 25, Verbena officinale; 26, Santolina; 27, Angelica; 28, Lythrum salicaria; 29, Anthemis pyrethrum. The inventor places the flowers and leaves above enumerated in a glass vase or bottle, mixing them in about equal proportions; he then presses them gently down with the hand, and pours upon them as much wine brandy as will cover them, leaving the whole to macerate and steep at an ordinary temperature during thirty days, when he filters, and the liquor is ready for use. *Patent abandoned.*

344. J. MALLISON. *Certain improvements in the process and method of dyeing yarns.* Dated February 7, 1863.

This invention consists in dyeing yarns whilst in an extended state, as in sizing and dressing machines, so that they may be dressed and wound on to the finished or weavers' beam in a dyed state, whereby the subsequent dressing (to which warps dyed in the usual manner are submitted) is dispensed with. *Patent abandoned.*

345. G. TURNER. *Improvements in means or apparatus for mincing or cutting meat or other substances.* Dated February 7, 1863.

One part of this invention relates to apparatus in which one set of cutting or dividing blades or teeth are applied to a horizontal axis, and the other set of blades or teeth are stationary in the barrel or cylinder, and has for its object improved means of supporting the outer end of such axis, or that farthest from the handle or driving means, adapted to facilitate the passing away of the meat or other substance as cut or minced. For this purpose the patentee forms the last of the fixed blades or teeth into the support for the outer end of such axis; or he forms the outer support with inclined or knife edges to act in carrying the substance cut in a forward direction. Other of the fixed blades may also aid to support the axis. He also, in some cases, applies the outer revolving blades or dividers beyond such support. *Patent completed.*

346. W. T. COOPER. *Improvements in distilling apparatus.* Dated February 7, 1863.

This invention consists in affixing to the head or beak of the still a jacket cylinder formed by two cylinders one within the other, leaving a small space between them in which part of the spirit to be distilled or rectified is introduced. The inner cylinder is shorter by about one-third than that of the outer cylinder, and contains several moveable and perforated pans or dishes, upon which the charcoal, berries, roots, or other substances or materials are placed when required. There is also a perforated moveable cover to the inner cylinder. When the still is in operation, the spirit in the jacket or space between the two cylinders rises and overflows the perforated cover of the inner cylinder and trickles through the perforated pans; the hot vapour from the still meets it, and converting a portion of it into vapour, carries it into an apparatus, which the inventor calls "quadruple analyser," the more aqueous portions running into the still to be converted into vapour. The quadruple analyser consists of an upright tube or cylinder partially surrounded with water, whence the purer portions of the vapour pass through regulated openings into three other tubes or cylinders for a complete separation of the essential oils; the vapour then passes into the ordinary worm or refrigerator. The portions collected while passing through the quadruple analyser fall into a chamber in connection therewith, and are thus drawn off as reconveyed to the still by suitable pipes. *Patent abandoned.*

347. C. PARIGOT and A. GRIVEL. *Combination eccentric locks.* Dated February 7, 1863.

This invention relates to an improved keyless lock with various combinations applicable for all kinds of fastenings. The patentees term this an eccentric lock, the throw of the bolt being effected by eccentrics; this arrangement of lock offers the following advantages:—1, It dispenses with the use of a key, which may be mislaid or lost. 2, It dispenses with springs, and so leaves the interior of the lock free, which permits of making the bolt much stronger, while the lock works much easier, and is less liable to derangement. 3, Its combinations render the lock unpickable, and these may be multiplied to any degree by increasing the number of rings on which the principle of the combination is based. 4, The lock is hermetically closed, and is thereby kept clean, may be made cheaply, and will last a great length of time. *Patent completed.*

348. W. CLARK. *Improvements in the application of gas for the preparation of woodwork generally and iron ships for their better preservation and reception of paint or other protecting coating, and for disinfecting ships, hospitals, and other places.* (A communication.) Dated February 7, 1863.

In carrying out this invention, a jet of gas in ignition, which may be either lighting gas or gaseous oxide of carbon, is projected on to the surface of the hull, and in order to render its action more efficacious and char surfaces with greater rapidity, the gas should (as stated in a former patent) be condensed before issuing from the nozzle, or to a certain pressure; and also to quicken combustion heated air should be injected by means of a blower in combination with the gas. Now this invention further relates to new applications of the said mode of carbonization for searing or charring surfaces intended to resist destructive influences. For example, iron ships require coating with a protective paint, and on returning from a voyage the old coating must be removed by scraping, and replaced by a fresh one. *Patent abandoned.*

349. J. JAMES. *An improved covering for hooped skirts.* Dated February 7, 1863.

The present invention is intended to prevent the destruction of the skirt by the friction of the hoop, and consists in the application of a material—viz., leather, that will resist and prevent the friction alluded to, and that will at the same time form an ornament as a trimming to such articles of dress. *Patent abandoned.*

350. J. MILLER and W. STRUTHERS. *Improvements in securing the corks, stoppers, or lids of bottles, jars, and other similar vessels.* Dated February 7, 1863.

Under one modification or system of arrangement two holes are formed in the neck of the bottle or jar during the progress of manufacture, or while the bottle, jar, or other similar vessel is in a sufficiently softened state to admit of the material being easily pierced. These holes are by preference made in the thickened part or rim which forms the mouth of the vessel, bottle, or jar; and they are made opposite to one another, so that when the vessel is filled, and the cork or stopper is inserted, a short length of wire, a pin, or other retaining medium may be easily passed through the cork. *Patent abandoned.*

351. M. HACKFORTH. *Improvements in shades or reflectors for lighting purposes.* Dated February 7, 1863.

This invention relates to a new manufacture of shades or reflectors for lamps or lights of all kinds, and consists in forming them of porcelain or china. These materials afford an economical reflector or shade, which can at all times be easily cleaned from dirt and other impurities by simply washing them with water. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 20, 1863.

1549. G. Brixley, Maida-hill. Improvements in apparatus and implements for cleaning spoons and forks.

Dated June 27, 1863.

1614. T. Dunn, Windsor Bridge Iron Works, Manchester, engineer. Improvements in the construction and maintenance of the permanent way of railways.

Dated July 27, 1863.

1865. G. Haseltine, 12, Southampton-buildings, Chancery-lane, civil engineer. Improvements in coal oil lamps. (A communication.)

Dated July 28, 1863.

1872. A. A. Antoine Baron de Rostaing, Paris. An improved method of manufacturing iron and steel with cast iron taken in the subdivided state.

Dated August 1, 1863.

1909. E. Sutton, Palace-road, Well-street South, Hackney, silversmith. Improvements in fastenings for cigar cases, portemonnais, bags, and other like articles.

Dated August 10, 1863.

1971. R. J. Cunnack, Helston, Cornwall. Improvements in the manufacture of cartridges for blasting and projectile purposes.

Dated August 11, 1863.

1975. E. Myers, 2, Millbank-row, civil engineer, and H. Forbes, 6, Aberdeen-place, Maida-hill. An improved rotary pump.

Dated August 13, 1863.

1997. J. Ellis, Liverpool, millwright and engineer. Improvements in machinery for scouring, cleaning, and polishing wheat, rice, malt, grain, and other seeds.

1999. H. Winchcomb, 3, China-walk, Lambeth, London, labourer. Improvements in street letter-boxes and bags for the reception of post letters.

2001. T. Ashwin, Birmingham, accountant clerk. A new or improved dress fastening, which said fastening may also be applied to the fastening of braces, belts, and other bands, and to other like purposes.

2003. J. Henderson, Bradford, Yorkshire, carpet manufacturer. Improvements for preparing yarns for printing.

Dated August 14, 1863.

2008. C. Schiele, Manchester, engineer. Improvements in fans, pumps, and machinery for propelling air, fluids, or other substances by centrifugal force.

2011. E. Taylor, Salford, machinist. Certain improvements in machinery or apparatus for churning.

2013. F. J. Jones, Aldermanbury, London, manufacturer. Improvements in locks or fastenings.

2014. M. H. Lishman, Stockton-on-Tees, accountant. Improvements in machinery for punching and for marking plates in which holes are to be punched.

2015. M. Siegrist, Ewell, Surrey, gentleman. Improvements in railway brakes actuated by the pressure of the atmosphere.

2017. J. Wain, Manchester, mechanic. Improvements in machinery or apparatus for doubling or twisting yarns or threads of cotton and other fibrous materials.

Dated August 15, 1863.

2019. J. W. Hoffman, Rydon-street, Middlesex. Improvements in apparatus for producing optical illusions for stage effect in theatres or exhibitions.

2021. G. Yates, Oswaldtwistle, engine driver. An improved means or method of indicating the number of tubs or other measures or quantities of coal or other substance or material drawn from pits or mines.

2025. R. Smith, Hyde-road Paper Staining Works, Manchester, and J. Booth, Gorton, Manchester, manager. Improvements in the manufacture of paper-hangings.

2027. F. Flavell, Welton, Daventry, machinist. Improvements in shakers for thrashing machines.

2029. T. Brooks, Wyld's Rents, Long-lane, Bermondsey, engineer. Improvements in means or apparatus for the production of charcoal and other products from refuse tan and other woody substances.

2031. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improved apparatus for printing. (A communication.)

2033. E. H. Bentall, Heybridge, Essex, agricultural implement maker. Improved machinery for thrashing corn and other grain or seeds.

2035. A. W. Parker, Bristol Soap Works, Bristol. Improvements in the manufacture of soap.

Dated August 17, 1863.

2037. A. M. Dearn, Greenstead Works, Colchester, engineer. A new centrifugal disc mashing machine.

2039. H. A. Bonneville, 24, Rue du Mont Thabor, Paris, and 38, Porchester-terrace, Bayswater. Improvements in the processes and preparations employed in spinning wool. (A communication.)

2042. T. Loftus, Preston, mechanical engineer. Improvements in apparatus for attaching to steam boilers and flues for the consumption of smoke.

2043. J. S. Crossland, Ashton-under-Lyne, engineer. Improvements in lubricating, and in arrangements and mechanism for lubricating the bearings, journals, or steps of spindles, shafts, axles, and other mechanism.

Dated August 18, 1863.

2045. J. Arthur, 1, Robert-terrace, Chelsea. An improved apparatus for the prevention, cure, and relief of hernia of every description, together with prolapsus uteri, uterine hemorrhage, hernia humoralis, and as a general support for enlargement of the abdomen from whatever cause proceeding.

2047. J. Brennand, Burnley, cotton spinner. An improved construction of firebars and apparatus connected therewith.

2049. T. Dobb, Rotherham. Improvements in chimney tops, which improvements are also applicable to coverings for ventilating shafts or flues for mines and other places.

2050. A. Cruickshank, Glen Park, Lanark, gentleman. Improvements in the manufacture or production of food for cattle and all other domestic animals, poultry, and game, and in the machinery or apparatus employed therein.

2051. J. Yates, Rotherham, iron master. Improvements in the manufacture and fitting or securing of armour plates, blocks, or bars, and in the machinery or apparatus employed therein, parts of which improvements are applicable to heavy forgings generally.

2053. R. A. Brooman, 166, Fleet-street, patent agent. An improved method of, and apparatus for, treating molasses, syrups, saccharine juices, and other products. (A communication.)

2055. C. H. McCormick, Chicago, United States, manufacturer of reaping machines. Improvements in reaping machines.

Dated August 19, 1863.

2057. W. Jackson, mechanic, 4, Spring-terrace, York-road, Lambeth. Improved arrangements of the parts in sewing machines using shoemakers' wax thread suitable for heavy boot or other leather work to which it may be applied.

2059. T. Howard, Hyde, Chester, cotton manufacturer. Certain improvements in machinery for spinning cotton, flax, wool, silk, and other fibrous substances.

2061. G. T. Bousfield, Loughborough-park, Brixton. Improvements in apparatus for feeding weft in hair cloth looms. (A communication.)

2063. G. Bonelli, Turin, engineer, and H. Cook, Gloucester-square, Middlesex, gentleman. An improved mode of, and apparatus for, producing by the aid of photography optical illusions of moving animals and bodies.

Dated August 20, 1863.

2066. W. and J. Galloway, Manchester, engineers. Improvements in steam boilers, and in steam and water gauges for the same.

2067. S. Hallsworth, Elland, near Halifax, and T. Platt, Fairfield, near Manchester. Improvements in the manufacture of certain colouring matters known as Prussian blue, Berlin blue, Paris blue, China blue, and Turnbull's blue.

2069. J. Fleming, Newlandsfields, Renfrew. Improvements in preserving the colours of dyed fabrics.

2070. J. Platt, Oldham, mechanical engineer, and W. Richardson, mechanical engineer. Improvements in machinery or apparatus for cleaning cotton and wool from seeds, burrs, and other extraneous matters.

2071. J. Platt, Oldham, mechanical engineer, and W. Richardson, mechanical engineer. Improvements in machinery or apparatus for winding narrow laps of wool.

2072. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the manufacture of cartridges. (A communication.)

2073. C. D. Hammond, Charlotte-street, Bedford-square, doctor of medicine. Improvements in apparatus for the treatment of certain bodily ailments.

Dated August 21, 1863.

2074. J. F. Hill, 23, Little St. Andrew-street, Upper St. Martin's-lane. An improved ventilating gas lamp or gaselier.

2075. J. Eccleston, Manchester, organ builder. Improvements in apparatus for economizing or regulating water power used for blowing organs or harmoniums, which improvements are also applicable for other purposes where an irregular motive power is desired.

2078. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in expressing and filtering oil from seeds, and liquids from other substances containing the same, and in apparatus employed therein. (A communication.

2079. W. Evans, Belgrave-street, Commercial-road East. An improved artificial fuel.

2080. R. Griffiths, Mornington-road, Regent's-park, engineer. Improvements in the construction of retorts or ovens for extracting oil from certain descriptions of cannel coal or other bituminous substances.

2081. E. Pope, Clonmel, Ireland, gunmaker. Improvements in breech-loading firearms.

Dated August 22, 1863.

2083. T. Pegram, 22, Cardington-street, St. Pancras, photographic artist. A plate holder for the photographic camera, adapted to carry different sized plates, each plate being on the same plane and in the same focus.

2084. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in closing powder canisters and other vessels. (A communication.)

2085. A. Watson, King-street, London, engineer. An improved method of, and apparatus for, inserting pictures in and withdrawing them from photographic albums.

2086. R. A. Brooman, 166, Fleet-street, patent agent. A new metallic alloy. (A communication.)

2087. L. E. C. Martin, 32, Albion-street, Hyde-park. Improvements in apparatus for heating and purifying water.

2088. S. Moore, Liverpool-street, Bishopsgate-street. Improvements in the means of, and apparatus for, electro-plating, said apparatus being also applicable to medical purposes.

2090. W. Benson, Leeds, machine and tool maker, and P. W. Greenwood, Leeds, mule spinner. Improvements in preparing and spinning wool and other similar fibres.

Dated August 24, 1863.

2092. A. Jobson, Darlington, Durham, colliery agent. Improvements in machinery for drawing or discharging coke ovens and loaking coke waggons.

2094. C. S. Grasset, Larnoca, Cyprus, Turkey. An improved double McCarty gin or machinery used for cleaning cotton from its seeds.

2095. A. Capello, 4, Rue du Repentir, Marseilles, currier. An improved method of, and apparatus for, glazing morocco leather.

2097. H. F. McKillop, Belvedere, Kent, captain in the Royal Navy. Improvements in cleansing ships' bottoms.

2098. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in air and gas engines. (A communication.)

Dated August 25, 1863.

2100. G. E. Lewis, Birmingham, gun manufacturer, H. Walker, Birmingham, machinist, and J. B. Wayne, Birmingham, machinist. Improvements in breech-loading firearms.

Dated August 26, 1863.

2104. T. Hopkins, jun., White Hart-place, Kennington-cross, coach beader. Improvements in carriage door handles.

2105. J. Taylor, Gomersall, Leeds. Improvements in the manufacture of soap. (A communication.)

2108. T. Westhorp, Falcon Works, Bromley. Improvements in machinery or apparatus for preparing cut rope, strands, or yarn for carding into oakum.

2109. R. Johnson, Manchester, iron and wire manufacturer, and G. Bedson, manager. Improvements in pointing wire rods or wire, in order to facilitate their introduction into draw plates.

2110. W. E. Newton, 66, Chancery-lane, civil engineer. Improved apparatus for extracting coal ores or other minerals or substances from mines, which apparatus may be also employed for raising and lowering the workmen and their tools or implements. (A communication.)

2111. J. Platt, Oldham, mechanical engineer, and W. Richardson, mechanical engineer. Improvements in stoves or grates.

2112. J. Fry, Chesham, Buckingham, engineer. Improvements in mashing machinery used in making fermented liquors.

2113. D. Blake, Manchester. Improvements in shaping and punching metallic articles, and in the machinery or apparatus to be employed therein. (A communication.)

2114. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in obtaining and applying motive power. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, September 8, 1863.

1022. J. Cornes and J. C. Davis. Lawn mowing, rolling, and collecting machines.

1056. W. Hudson and C. Catlow. Looms.

1061. S. Crabtree. Balling motions.

1062. G. Hall and J. Wells. New explosive compound.

1069. T. Moore. Laying down, protecting, and controlling submarine cables.

1077. W. Tarr and E. Farr. Pianofortes.

1078. W. E. Gedge. Permanent advertisement. (A communication.)

1081. H. Worms. Elevating guns.

1082. M. Barland and E. H. C. Monckton. Withdrawing milk from cows and other mammiferæ. (Partly a communication.)

1087. J. Wibberley. Winding cotton, silk, wool, or other threads on spools or reels.

1093. J. Appleby. Propelling ships and barges.

1094. J. H. Johnson. Rotary engines. (A communication.)

1097. W. Clissold. Fulling woollen cloths and washing and cleansing woven fabrics.

1102. J. W. Gibson and W. Turner. Springs.

1104. J. Purley. Breech-loading firearms.

1105. S. J. Partlett. Straining and drawing off liquids.

1112. B. G. Sloper. Separating metals from earthy and other matters.

1115. J. H. Johnson. Manufacture of wrought iron and steel. (A communication.)

1138. J. Park. Communicating motion to machinery for manufacturing paper pulp.

1147. J. B. P. A. Thierry. Arrangement or construction of furnaces.

1154. J. H. Bailey. Mechanical movement for producing an impelled current of air for lamps, and which may be used for other purposes. (A communication.)

1156. W. Clark. Coating wrought or other iron to protect it from corrosion or oxidation. (A communication.)

1247. J. Beaumont. Condensing machines.

1273. F. P. Warren. Attaching copper or other sheathing to iron vessels.

1277. W. H. Clapp. Rail or holder for coats or other articles.

1293. E. Barlow, J. Ashworth, jun., J. Newhouse, F. Hamilton, and W. Hope. Lap machines for preparing cotton and other fibrous substances.

1360. V. Baker. Ordnance.

1420. J. G. Jones and R. Ridley. Apparatus for working coal and other mines.

1618. J. Chatterton. Lining iron and other tubes and hollow vessels.

1650. F. Ransome. Coating or preserving iron ships or vessels

1753. L. M. Bornique and J. B. Vidard. Railway carriages.

1754. L. M. Bournique and J. B. Vidard. Improved waggon or truck.

1857. P. E. Gay. Boring apparatus.

1968. P. M. del Rio. Obtaining motive power.

2012. E. B. Wilson. Blast furnaces.

2055. O. H. McCormick. Reaping machines.

2061. G. T. Bousfield. Feeding weft in hair cloth looms. (A communication.)

2069. J. Fleming. Preserving the colours of dyed fabrics.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed September 2, 1863.

640. J. Isherwood.
653. P. Hugon.
655. W. J. Clapp and N. Coats.
660. R. T. and R. Monteith.
670. J. Werge.
681. J. Tomlinson.
677. W. Clark.
681. J. Harris, J. Butler, and J. H. Fraser.
732. A. Morel.
761. W. Clark.
788. R. Mushet.
1602. R. Mushet.
1649. E. Lloyd.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2114. W. Holroyd and S. Smith.
2133. G. P. Wheeler.
2134. G. P. Wheeler.
2153. R. Wright.
2166. J. Hamilton, jun.
2186. W. Wilkinson and H. T. Wright.
2212. J. Chesterton.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2062. Earl of Aldborough.
2070. R. Wilson.
2093. F. M. Herring.
2089. J. Fowler, jun.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated August 26, 1863.

2102. J. W. Friend, Freemantle, Southampton. Improvements in the construction of gas meters, and in apparatus to be employed in connection therewith for regulating the pressure and flow of gas to the same.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending September 5, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
141	0 8	189	0 4	199	0 4	210	1 4	219	0 4	228	0 4
142	0 6	190	0 4	200	0 4	211	0 6	220	1 0	229	0 4
145	0 8	191	1 4	201	0 10	212	0 4	221	0 4	230	0 10
155	1 0	192	0 4	203	0 6	213	1 6	222	0 4	231	0 4
178	0 10	193	1 0	204	0 4	214	0 4	223	0 6	232	0 6
181	0 4	194	0 4	205	0 4	215	0 4	224	0 4	233	0 4
183	0 10	195	0 4	206	2 0	216	1 4	225	0 8	236	0 4
184	0 8	196	0 4	208	0 8	217	0 10	226	0 8	239	2 4
185	0 4	197	0 4	209	0 4	218	0 4	227	1 4	240	0 4
187	1 4	198	0 4								

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

IRON:—

		£ s. d.		£ s. d.	p ct.
Welsh Bars, in London	per ton	7 10 0	to	7 0 0	2½
Nail Rods	do	8 0 0		0 0 0	
Hoops..................................	do	9 0 0		9 0 0	
Sheets, single	do	10 0 0		0 0 0	
Staffordshire Bars............ ..	do	8 5 0		0 0 0	
Bars, in Wales	do	6 7 6		6 7 6	
Rails	do	6 5 0		6 10 0	nett
Foundry Pigs, at Glasg, No 1	do	2 15 0		2 18 0	
Swedish Bars	do	11 10 0		12 0 0	2½

		£ s. d.	£ s. d.	
STEEL:—				
Swedish Keg, hammered ...	do	16 0 0	16 5 0	
Swedish Faggot	do	17 0 0	18 0 0	
COPPER:—				
Sheet & Sheathing, & Bolts...	do	103 0 0	0 0 0	
Hammered Bottoms...........	do	112 0 0	0 0 0	
Flat Bottoms, not Hamrd....	do	107 0 0	0 0 0	
Tough Cake and Ingot	do	95 0 0	0 0 0	
Tile Copper	do	89 0 0	0 0 0	
Best Selected	do	98 0 0	0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10	0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½	0 0 0	
Fine Foreign	per ton	98 0 0	0 0 8½	
			100 0 0	
TIN:—				
English Block.....................	per cwt.	5 15 0		
do Bar............................	do	5 16 0	0 0 0	2½
do Refined........................	do	6 0 0	0 0 0	
Banca	do	6 4 0	0 0 0	
Straits..................................	do	5 16 0	0 0 0	
			0 0 0	
TIN PLATES:—				
Best Charcoal, I.C..............	per box	1 8 6	1 9 0	
Second Quality	do	1 7 0	1 7 6	
Coke	do	1 3 0	1 4 0	
LEAD:—				
Pig, English.......................	per ton	20 10 0	21 5 0	
„ Spanish Soft	do	19 7 6	19 10 0	
Shot, Patent........................	do	23 10 0	0 0 0	
Sheet	do	21 0 0	0 0 0	
White....................................	do	27 0 0	27 10 0	
SPELTER:—				
On the spot	do	18 15 0	0 0 0	nett
ZINC:—				
English Sheet	do	23 0 0	24 0 0	2½
QUICKSILVER.....................	per btl.	7 0 0	0 0 0	3
REGULUS OF ANTIMONY:—				
French star	per ton	34 0 0	0 0 0	

TIMBER, duty 1s. per load, drawback 1s.

	£ s.	£ s.
Teak.............. load	£12 0	£13 0
Quebec, red pine	3 10	4 10
„ yellow pine .	3 10	4 10
St. John, N.B., yellow	0 0	0 0
Quebec oak, white ...	5 10	6 10
„ birch............	3 10	4 10
„ elm	3 10	5 0
Dantzic oak	3 10	6 10
„ fir	2 10	3 10
Memel fir	3 5	3 10
Riga.......................	3 0	3 5
Swedish	2 10	2 15
Masts, Quebec red pine	5 0	6 0
„ yellow pine	5 0	6 0
Lathwood, Dantzic, fm	5 10	6 10
„ St. Petersburg	8 0	8 10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.		
Quebec, white spruce	15 10	18 10
St. John, white spruce	14 0	15 10
Yellow pine, per reduced C.		
Canada, 1st qual. ...	17 0	18 0
„ 2nd do......	11 0	12 0
Archangel, yellow...	£13 0	13 10
St. Petersburgh, yel.	11 10	12 0
Finlan	9 0	10 0
Memel	10 0	15 0
Gothenburg, yellow	10 0	11 0
„ white.	9 0	9 10
Gefle, yellow	10 10	11 10
Soderhamn	9 10	10 10
Christiania, per C., 12 ft. by 3 by 9 in.		
Christiania, yellow	21 0	23 0
Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 0
PUMICE STONE pr ton	6 10	0 0

OILS, &c.

	£ s.	£ s.
Seal, pale ...per tun	46 0	46 10
Sperm body	80 0	0 0
Cod........................	35 0	35 10
Whale, Sth Sea, pale	42 10	0 0
Olive, Gallipoli	60 0	0 0
Cocoanut, Cochin...	47 0	47 10
Palm, fine	35 10	36 0
Linseed..................	41 0	0 0
Rapeseed, Eng. pale	45 0	0 0
Cottonseed	33 0	40 0

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THE MECHANICS' MAGAZINE.

Contents of the Last Number:— PAGE

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 18, 1863.

GUNS FOR THE NAVY.

THE present American war is distinguished by a series of the most important experiments in ordnance ever conducted—experiments the value of which cannot be over-estimated, because they are carried out under all the exigencies of practical warfare, and are in this respect infinitely superior to anything we have done at vast expense at Shoeburyness, and elsewhere in England. It is extremely unfortunate that all the reports we have of the performance of American guns are wanting in detail; and, although the main facts may be correct, we are unavoidably compelled to draw our deductions, in a great degree from analogy, in the absence of minute information. Nevertheless, we have at our command certain salient points, from which much valuable information may be derived, and many circumstances reach us with an amplitude, sufficient to entitle them to consideration as proved facts, calculated to guide us in our future proceedings.

Although both England and France have done much toward the introduction of heavy ordnance into their forts and navies, the goddess of peace has hitherto prevented us from practically testing the capabilities of guns intended to throw shot, ten or twenty of which would make up a ton. In America the case is different; and we find that the resources of the military engineer and the naval architect, have rendered a recourse to enormous ordnance all but indispensable; and compelled by practical difficulties to throw theory almost wholly overboard, the rival Governments have each distinguished the real value to be attached to range and accuracy, both as distinct from, and combined with, smashing effect and penetrative power. On land, rifled guns of long range and extreme accuracy are rightly deemed of the utmost value, and we find in consequence that American parks of artillery are usually distinguished by the presence of numerous guns, sufficiently like those of Whitworth and Armstrong to be regarded as nearly identical. None of these field-pieces are heavy, or intended to throw shot of any considerable weight; but, being well served, they have done tremendous execution at ranges which would be looked on as fabulous fifty years ago. A just appreciation of what was required from the "Monitors" and iron-clad steamboats, has secured to them an armament, the great characteristic of which is immense smashing power at a considerable range, without any great pretensions to accuracy. Our readers are too well acquainted with the performance of these guns to require any elaboration of the results at our hands.

Hitherto we have been unsuccessful in the introduction of any guns throwing shot much exceeding 100lb. weight. This arises from a misapprehension of the mission which very heavy ordnance is calculated to fulfil; from a faulty principle of construction following as a consequence; from defective materials, and imperfections in the mode of formation. In all these respects, our practice differs materially from that of the Americans. We attach little or no value even to a 200lb. gun if it be not rifled. The moment we obtain a smooth-bore of the kind, it is sent to the shops to be rifled—destroyed in consequence—pronounced a failure, and all large guns included in a sweeping condemnation. Our American friends, on the contrary, are content with the smooth-bore, well knowing that sharp rifling, heavy shot, and sufficient powder to attain a long range, are incompatible in the present state of the iron manufacture: hence their papers teem with reports the truth of which we see no reason to doubt, of the performance of 150lb. and 200lb. guns, spoken of, too, with a familiarity which shows that their use is, if not universal, at least general. It will be urged that the "Monitors" are armed with heavy rifled guns as well as smooth-bores; but we must remember that the American rifling is very different from ours—in fact, the system of grooving applied to most of their heavy cannon would scarcely be considered to deserve the name here, so slow is the twist.

It is extremely erroneous to conclude that all these guns are made of wrought iron. Even without the positive evidence on the subject placed at our command; we have the negative information, derived from our own failures, to prove that the manufacture of heavy guns from wrought iron is uncertain in the extreme. The American forges are certainly superior in no way to ours, in dealing with large masses of iron; and the Ordnance Department of the United States was so well impressed—as far back as the year 1841—with the importance of perfecting the manufacture of cast-iron guns, that able officers were appointed to every cannon foundry under contract with the Government, to conduct experiments, and see that all the resources of science and art were employed to produce the best possible ordnance. Some brands of American cast iron are infinitely superior to anything we can produce here. Inspection has increased the average strength of cast-iron cannon from 23,638 lb. to 37,774 lb. of transverse strain per square inch of section. The principle of re-melting is largely carried out, in some experiments the transverse strength of the iron having doubled by four meltings. This principle, combined with a careful admixture of different samples, and the exposure of the melted iron to a very intense heat for considerable periods, is found so far to improve its quality, that a sample was obtained at the Greenwood Foundry, N.Y., the density of which was 7·304, and its tensile strength 45,970 lb.! When we state that our best irons seldom exceed half this—23,000lb. being a high average—we are in a position to understand why cast-iron ordnance succeeds better in America than in Great Britain. Bronze guns are little used, except for the smallest pieces, its great expense and the uncertainty of the quality produced, condemning it for heavy ordnance. Major Wade's experiments in 1850 showed a difference in the density of various samples, taken from the same gun, equal to 20 lbs. to the cubic foot, the variation in tenacity being as 100 is to 236. A large proportion of the cast-iron ordnance is constructed on the "Rodman" principle. The guns are cast hollow round a central core, through which a stream of cold water, entering at the bottom, flows continuously, until the gun has become much cooled. Two 8-in. guns, cast the one hollow the other solid, were discharged repeatedly. The one cast solid burst at the 73rd fire, while the other withstood 1,500 rounds, and was pronounced practically indestructible with service charges. We have already stated that the heaviest guns used in the American Navy are, as a rule, either smooth-bores, or, if rifled, the grooves have an extremely moderate twist, the general principle of construction being to impart just such a velocity of rotation, and no more, to an elongated projectile, as will secure it from turning over in its flight. When the shot is made short in proportion to its diameter, very little suffices for this, and the gun is thus saved from the strain due to sharp rifling. The range is maintained with a smaller quantity of powder, and the accuracy of flight is preserved sufficiently for practical purposes. Range is imperially affected by the resistance of the atmosphere. The resisting surface area of the Armstrong shot is to the 68-lb. spherical projectile as 10 is to 50, while the expansive range of the powder is nearly 24 to 15. These are the conditions which secure range; to which rifling is really, in the abstract, inimical. Were it possible to discharge a conical shot, with a length of four or five diameters, from a smooth-bore, its range would be nearly double that of the Armstrong gun; and though this is to a certain extent impracticable, there is nothing, probably, to prevent the construction of a 100-lb. gun, which would pierce the "Warrior's" side at 1,200 yards, with a charge which even a good cast-iron gun might sustain many hundreds of times without injury. It would only be necessary to use a shot two or three diameters long, fitted so accurately as practically to prevent windage, while five or six grooves, making perhaps one-tenth of a turn in the length of the gun, would secure the end on flight of the projectile. It is very unlikely that such a gun would have sufficient accuracy to pick off a field officer at a range of a couple of miles, nor is there any reason that it should. We strain every nerve to supply our ships with arms of precision, forgetting that the conditions essential to the proper exercise of their powers can never be secured at sea. The officers on board the "Excellent," when experimenting on rifled guns by firing at a fixed mark, found "that there being no wind, and the tide keeping the vessel steady, they were sure of hitting it. Immediately the wind was a little too strong for the tide, and the vessel moved about; there was a considerable difference in the precision of the firing, although the water was as smooth as glass." Smooth seas and balmy breezes are rather the exception at sea, and neither Whitworth nor Armstrong would stand much chance of hitting a vessel even a mile off in a gale. The proper place for long range guns of great precision, is in the fort, the battering train, and the park of artillery. On board ship they are out of place, simply because we cannot avail ourselves of their real points of excellence. The 68-lb. is considered defective, because it wants range and accuracy. In smashing power it stands pre-eminent. The wisest course is to impart the advantages of a modified system of rifling to an arm which we cannot really dispense with; such guns would thus be rendered capable of discharging conical projectiles much higher, and better calculated for long flights than spherical 68-lb. shot, without any considerable sacrifice of initial velocity. Iron plates 4½ in. thick would prove a poor defence at even 1,000 yards from such ordnance.

The principal strain on the material composing a gun is indirectly due to the force required to overcome the *vis inertia* of the projectile. The power required to start a heavy shot into rapid motion, in a space of time inappreciably small, is something enormous, and would seem to imperatively dictate a recourse to some expedient, which will put the shot gradually in motion; several have been resorted to. In America, Eaton's gun has proved very successful. This gun, which is of considerable length, is loaded with a cartridge filled with an extremely slow-burning powder next the shot, the rest of the charge is made up of the quickest powder which can be obtained. The charge is ignited in front, thereby starting the shot into motion. A 6-lb., at 5 deg. elevation, has

thrown its shot 2,457 yds.; at 10 deg., 4,000 yds.; at 2 deg., 1,100 yds.

The armament of our Navy becomes, if possible, of more importance day by day. Ship guns will now have to perform work such as they never had to perform before. Field artillery requires little change. The same work has to be performed by it now which it accomplished fifty or one hundred years ago. It will have to be done at greater ranges, that is all. If we draw the proper distinctions between the services, we shall at once see the folly of sacrificing weight of shot and penetrative power to the attainment of a precision of fire, which, for its proper development, absolutely demands a fixed basis. In guns of great size, grooved just enough to secure the leisurely rotation of shot carefully made, and so fitted that windage is impossible, will be found the real weapon for the Navy. We have evidence before our eyes of the actual performance of such guns on the American continent. The lesson is too valuable to be suffered to slip from us unimproved. We search in vain for the record of any ordnance experiments which decide the minimum amount of twist, requisite to secure the proper rotative velocity of a projectile. We believe the day is not far distant when such knowledge will be invaluable, for on it depends in a great degree the success of all large guns. Without elongated shot, we cannot have range, or penetration at distances. Without rifling, we cannot use elongated shot. The heaviest ordnance has hitherto failed when rifled; and in the reconciliation of these apparent incompatibilities, will be found the most serious problem which the science of gunnery every presented. We believe its solution lies in so modifying the rifled system, that the communication of a moderate rate of rotation may no longer increase the resistance to the motion of a projectile through the bore of a gun, to such an excessive degree as to lead to its immediate or ultimate destruction.

BOILER EXPLOSIONS.

The professional attainments of the Astronomer Royal are sufficient to entitle his expressed opinions on scientific subjects to more than ordinary consideration. We regret extremely that the report of his Paper, read before the British Association, and placed by us a week or two ago in the hands of our readers, is so extremely meagre, that we must for the present, perforce, receive it in the light of a series of assertions, rather than as something more than a theory deduced from proved facts. We prefer, therefore, to suspend our judgment for the time, in the hope that valuable details of the experiments by which Mr. Airy has arrived at his conclusions may, ere long, be at our disposal. It is not wonderful, that, of all the remarkable phenomena which attend the application of the powers of nature to the arts, steam-boiler explosions should have met with most attention. Their frequent occurrence, their fatal and destructive results, and the mystery in which they are enwrapped, chained the attention of the philosopher, almost from the first introduction of the steam-engine; and our magazines, journals, and scientific literature generally, for the last 50 years, have contained more absurdities penned on this subject than on, perhaps, anything else in the circle of science.

It is not our intention to weary our readers by going over oft-trodden ground. One theory, and one only, is gradually making its way into general acceptation. This theory is so well expressed in a pamphlet on Steam-boiler Explosions,* published in 1860, that we simply reprint the paragraphs which contain it. Mr. Colburn astributes violent boiler explosions to—

1. The rupture, under hardly if any more than the ordinary working pressure of a defective portion of the shell of the boiler; a portion not much, if at all, below the water line.

2. The escape of the free steam from the steam-chamber, and the consequent removal of a considerable part of the pressure upon the water, before its contained heat can overcome its inertia and permit the disengagement of additional steam.

3. The projection of steam, combined as it necessarily must be with the water, with great velocity and through a greater or less space, upon the upper sides of the shell of the boiler, which is thus forced completely open, and perhaps broken in pieces.

4. The subsequent disengagement of a large quantity of steam from the heated water now no longer confined within the boiler, and the consequent projection of the already separated parts of the boiler to a greater or less distance.

When a theory is generally received as correct in the scientific world, we usually find very many claimants for the honour of its origination. The present is not an exceptional case, and we have gone with some care into a mass of conflicting evidence on the subject, simply with the desire that truth might be made apparent. Years ago, we find Harshman and others, contending that the violence of an explosion was due, indirectly, to the quantity of water contained in a boiler. Harshman's theory was however, simply absurd. He considered that some mysterious electrical action developed the "polar forces" (whatever they were?) in the water; and, rejecting all that science said on the relations between the water contained in a metallic generator, and electricity; floundered into a sea of doubt and uncertainty. Harshman was, however, an able expositor of the doctrines, nearly identical with his own, held by many others; and it is simply for that reason that we have singled him out from a number. The first rational exposition of the causation of an explosion—properly so called, and distinct from quiet rupture—is to be found in the pages of the *Engineer*, in the latter part of the year 1859. As Mr. Colburn has since identified himself with this exposition in the pamphlet we have quoted, we feel no hesitation in attributing to him the origination of the theory—that once rupture has commenced above the water line, "a great additional power is released, sufficient to complete the explosion and give it all the violence by which such explosions are usually characterized." The *Engineer* theory, however, went no further at that time, than stating that the percussive action of the large quantity of steam evolved from the heated water, was the proximate cause of that tearing and rending of the plates which usually takes place. Mr. D. K. Clark, in February, 1860, followed up Mr. Colburn's theory, and supplying the one item in which it was apparently defective, suggested, in a letter addressed to the Editor of the Mechanics' Magazine in that month, "that the sudden dispersion and projection of the water against the bounding surfaces of the boiler was the great cause of the violence of the results." Mr. Colburn deeming these views correct, incorporated them with his own theory, giving Mr. Clark, in his pamphlet, full credit for the suggestion; indeed, republishing Mr. Clark's letter from the Mechanics' Magazine; and thus the theory at present received is due to Mr. Colburn in the first place, and to Mr. Clark in the second.

Now, as we understand this theory, the propulsion of the water in masses of greater or less size against the upper plates, is supposed to take place; and that it is to the momentum of these masses that the destruction of the plates is due. If the theory is to be taken with this understanding, then we believe that Mr. Colburn's theory is injured, perhaps, rather than benefited by the addition of Mr. Clark's. Every atom of which the water contained in the boiler consists, equally repels its fellows, under the action of, so to speak, the atmosphere of heat which pervades the mass. On the sudden release of pressure, we cannot conceive why one portion of the water would be more readily converted into steam than another; and consequently—though we can conceive the dispersion of the water into a very fine mist—we cannot understand its propulsion anywhere in masses. We have performed some experiments on very small boilers, with flat unstayed heads of tin plate. These heads were invariably blown out bodily, and every drop of water dispersed; not so much in steam, as in a fine mist, which, ascending to a considerable distance, usually became absorbed by the atmosphere without descending again. We are strongly disposed to attribute this dispersion of the water *not to the production of interstitial steam, but to the direct action of the heat stored up within the water.* It is by no means improbable that very little steam, so called, is really produced in the first moment of an explosion, but it is not difficult to conceive that the particles of water, retained in union only by external pressure, may on its removal be violently forced asunder to a short distance—when compared with the state in which they exist in steam—yet with a force sufficient to account for the most violent results ever produced. If we take Joule's estimate of 772 foot-pounds as the equivalent of a unit of heat, and reflect that half a ton of coal is often consumed in raising the water to the working temperature, we can conceive the vast amount of power then stored up ready to be released in the thousandth part of a second. This store of power is nothing but a store of heat; and we know of no reason why the water may not be separated into the atoms of which it is composed with all the violence of a terrible explosion, without any necessity for its conversion into true steam.

Professor Airy states that one-eighth of the whole volume of a body of water was evaporated in lowering the temperature from 293 deg. to 212 deg. Now, if we suppose that the particles of the water evaporated were separated from each other to a distance, sufficient to produce an increase of volume 1,800-fold, there is nothing to prevent the separation of the particles composing the whole body of water to one-eighth of this distance with precisely the same mechanical effort. The water thus expanded would not be true steam, yet the expansion would be the result of the entire mechanical force of the heat stored within the water, and, being exerted in an inappreciable space of time, would produce the most tremendous effects in its expansion. The case would be precisely similar if we suppose the water within a boiler increased in volume, say, one hundred times. We can easily imagine the result.

* Steam-boiler Explosions. By Zerah Colburn. London: John Weale. 1860.

STAMP END IRON WORKS, LINCOLN.

The greater part of the skill, dexterity, and judgment with which the productive power of labour is anywhere directed or applied seem to have been the effects of the division of labour. Such are the words of Adam Smith, the apostle of free-trade, and the founder of the science of political economy. To illustrate this principle, that great thinker traced out the various stages in the manufacture of a common pin. He could scarcely have anticipated that—60 years after the publication of his "Wealth of Nations"—the manufacture of a particular form of the steam-engine could be chosen for a similar illustration. A walk through the

Stamp End Works would, however, convince any engineer that this great principle can be as completely carried out with an engine as with a common pin. It seems to be held by many that the chief advantage derived from a complete division of labour merely consists in the ordinary increase of skill to any man long employed at a special job. This increase of skill, however, does not confine itself to the operative, but also extends to the men at the head of the different departments, and of the business as a whole. Again, a variety of work—preventing the adoption of an organized routine—causes a great loss of time in passing from one job to another—a loss of time, indeed, the amount of which, though great, it is impossible to ascertain from the books. On the other hand, numerous special machines can be profitably constructed and employed to manufacture details of which there is a repetition; and these special tools not merely lighten and shorten labour, but also greatly improve the quality and accuracy of the work. Instead of a skilled workman labouring at a great expense of skill and exertion, an unskilled operative merely directs the execution of the job; one man thus does the work of many; and indeed, most machines of this kind can be pointed out as being in themselves the sources of large incomes to the proprietors. The mere fact that a firm is able to devote its undivided attention to one or two classes of work is of itself an indication of special and general progress—special, as it is a universal suffrage vote for the quality of the articles delivered—general, as the division of labour is always the attendant of a high civilization; a pretension to universal science and ability was only acknowledged in the dark ages; while England herself is the country *par excellence* where the division of labour is the most completely carried out.

There are few manufacturing engineers so fortunate as to get a complete repetition of work—that *summum bonum* of the manufacturer—the sure road to fame and wealth—the only means of combining cheapness with good work. The Stamp End establishment, however, is able to almost entirely confine itself to the manufacture of portable engines and thrashing machines. Now there is no other form of the steam-engine, in the manufacture of which the division of labour can be so fully carried out as with portables. The locomotive, for instance, the elder brother of the portable engine, is not, numerically, in such demand. It is also seldom that an exactly similar type of locomotive is required in large numbers in succession. Orders are not often given out for more than a dozen similar locomotives at the same time. Such exceptions as the 50 locomotives manufactured some time ago at the Atlas Works, Manchester, are few and far between. When one of these exceptions does occur, and if a fair price be given, a fortune can be made by such an order, as the fruitful principle of the division of labour can then be carried out to its fullest extent. Towards the immense number of portable engines in use in different parts of the world—10,000 of which are estimated to be in use in England alone—the Stamp End Works have contributed, up to the end of last August, no less than 5,395 fixed and portable engines. It has been questioned by some people whether this establishment has really turned out such an astonishing number of engines, and in so short a time. Now, by special favour, we have been furnished with authentic proofs of the matter. Every engine, as it leaves the shop, receives a number, and this number is carefully registered in a book, together with the name of the customer, and all the particulars of the engines, such as the position of the tubes, and, in fact, an account characterising every working part. In case it be wanted to repair one of the 5,395 engines—and any engine, however well made, must be repaired at some time or other—the makers, on being simply furnished with its number, can instantly identify the engine; the detail ordered is at once sent to any part of the world where it may be required; and it can be at once applied to the engine in want of repair. This complete system for quickly and cheaply effecting repairs would be a point in favour of the Stamp End engines, even if they were not of a superior shape to most of the other engines in the market. Several unprincipled small makers completely copy the Stamp End engine, even to the smallest split-pin; and coolly state that "their engines are exactly like Clayton and Shuttleworth's." We doubt, however, whether any of these servile imitators have such a system for repairing their copied products. To those interested in agricultural statistics, the following table we compiled from the books, with the dates and numbers of the engines delivered each year, may be valuable. The largest engines made are those of 20-horse power; the smallest of 3-horse power, nominal:—

DATE.	NUMBER.	HORSE-POWER.
1845	1	8
1846	2	16
1847	8	73
1848	15	87
1849	55	316
1850	74	420
1851	126	611
1852	209	1153
1853	282	1608
1854	389	2117
1855	445	3074
1856	507	3611
1857	423	3174
1858	378	2837
1859	514	3941
1860	533	4075
1861	566	4409
1862	543	4276

Up to the end of last month 395 engines were made in the year 1863. Last week—the week ending August 29th, 1863—16 new and 2 old engines were turned out of the works. Of thrashing machines, 13 new and 3 old ones were delivered. Four straw elevators (Hayes), 3 flour-dressing machines, and 5 corn-mills were also completed. From 60 to 70 engines, and as many thrashing machines, are generally in the store-shop waiting for delivery. It is noticeable that the average size of portable engine now sold is 8-horse power; in 1855, 6-horse power, and in 1851, 5-horse power engines were most in demand. The call for 10-horse power engines is evidently due to the general adoption of steam cultivation, to which these engines can be easily applied. The manufacture of thrashing machines has advanced in a nearly parallel line to that of the engines. Last year they sold about 500 thrashing machines, making up a total of 4,500 Engines and thrashers form the staple of the Stamp End trade, but portable corn mills—the first of which was made in 1846—are also manufactured.

It will be seen by the above table that the importance of these works dates from what is a very short period in the life of an engineering establishment. Messrs. Clayton and Shuttleworth began manufacturing on an extremely small scale in 1842; in 1849, only fourteen years ago, they exhibited their first portable engine and thrasher at the Royal Agricultural Show at Norwich. From the year 1852, only ten years ago, did their establishment assume somewhat of its present position, and now they are the largest makers in the whole world of engines and thrashers, with off-shoot establishments at Vienna and Perth, and with extensive agencies in every civilized country. The excellent show made by this firm at the great Exhibition of 1851 added greatly to their prosperity. The sound character of the Stamp End workmanship became known to the public; its quality was recognised by the jurors of the Exhibition of 1851, and the firm received two medals for their engines. In common with most of the other exhibitors last year, two of the indiscriminately distributed medals also fell to the lot of the Stamp End firm. Marks of distinction in which so many thousands participated could not be of much value. We may, however, state that such engineers as Mr. Humphries, Mr. Penn, and Mr. Maudslay have testified their approval of the Stamp End make of engine—as exemplified in the engines they saw at South Kensington—by lately sending several orders to Lincoln. The neat little Stamp End engines are now doing duty in all parts of the world; they have thrashed out this year's corn, not merely in the happy homesteads of England, but also in the steppes of Russia, the *puztas* of Hungary, the Canadian prairies, and in the Australian bush. . . .

However much a man may feel bent to ascribe the prosperity of any undertaking of this kind to good luck, it is impossible for an engineer to stroll through these works without seeing that other causes besides have helped to bring forth this unexampled success. In the first place, the situation of the works is exceedingly well chosen. Placed in the centre of an agricultural district, and, at the same time, not too far from the principal manufacturing towns, the position of the establishment must have greatly forwarded its progress—particularly in the earlier stages of its career. The workshops are only a few yards from the Great Northern Railway, and the Manchester, Sheffield, and Lincolnshire line skirts round a great portion of the works. Branches from these two lines run right into the yard, and the line of rails is continued so as to give a complete communication between all parts of the works. A canal from the river Witham, at which point that river begins to be navigable, almost divides the place in two, and there is thus a complete railway and canal communication. The ground upon which the works are built was at one time the estuary of the river Witham; and this former swamp had to be drained and raised up 7 ft. by the addition of materials before the buildings could be erected. The entire area occupied by the works is rather more than 9 acres. The finished engines and machines are packed on the railway trucks from a high platform inclined towards the works—a plan by which the labour of several horses is economized. The different shops are very large and lofty, and are all lighted from the roof. This is the only way to efficiently light up workshops, as in the absence of skylights, the space in the middle is more or less lost. The principal offices are built in a style of absolute magnificence; the building looks more like a nobleman's mansion than a house built for the transaction of the business of a private firm. There are quite large gas-works on the ground, manufacturing 150,000 ft. of gas per week during the six months of the winter season. Nearly 1,000 operatives are employed in all, and with the addition of the clerks and the other officials, the total number of people engaged probably exceeds 1,000. The machines and tools are driven by stationary engines of 120 collective nominal horse power. For several years this establishment has been constantly "making overtime," up to 8 or

half-past 8 o'clock, and sometimes later, so that in reality the actual amount of work work turned out is greater than would be represented by the above number of men. We noticed that the beneficial institution of the Saturday half-holiday was introduced into these works—the men knocking off work at half-past 12 o'clock on that day.

Without attempting to give an exact account of the relative positions of the different workshops—a thing difficult to make clear without a ground-plan—we may state that, with the partiality of an engineer, we first examined the turning, fitting, and erecting shops, in which the fixed and portable engines are manufactured. Now we have been enabled at various times to inspect almost all the first-class shops of England, France, and Germany; but we may confidently state that we have never seen an engine manufactory with such complete arrangements for perfectly doing every detail by means of machine tools alone. Absolutely all the work—of, for instance, the engine connecting-rods—is done by machinery; the file is only used to take the slight burr or "arrage" off the edges of the straps and brasses. After carefully examining a finished connecting-rod we took at haphazard amongst a number in the store, we can state that it was a first-rate piece of fitting, and done entirely without the use of a file. The heads and straps are slotted and shaped; the cottar holes are done in a slot drill; the semi-cylindrical edge of the cottars themselves are shaped in a peculiarly ingenious lathe (by Smith, Beacock, and Tannet)—all the parts being made to case-hardened templets. The bright surfaces are not even draw-filed; in fact, they do not require it. We believe that the Master Workman of England—Mr. Whitworth—was the first to so completely dispense with the file. The eccentric-straps are made in a peculiarly advantageous way as regards exactitude and speed. The two halves are cast together, and turned up, then slotted in two, leaving a small space to be filled up by a packing piece for taking up the wear. The outsides of the eccentric clips are shaped in a kind of filing machine, in appearance like a small slotting tool, but fitted with a rough species of file, working up and down. The work is slightly drawn back by the machine during the return stroke of the tool. The system for finishing the cylinders is also excellent. The cylinders for double-cylinder engines are always in one casting, and the regulator valve is also cast on, thus doing away with unnecessary joints. These double cylinders are bored out on a specially-made boring lathe; the casting being fixed on a cross-slide, traversing parallel to the face plate. After one cylinder is bored out, the second can be immediately adjusted by merely sliding it across up to its centre. Both the single and double cylinders are first of all bored out in a very neat horizontal boring lathe, made by the firm itself. After being fixed on two special brackets with cones (clamped to the flanges), the valve-faces are planed out in a machine. The faces of the cylinder flanges are then turned up true in a lathe. Any mechanic can see that this system must make an accurate job, and without much expense. Not even the *contours* of the cylinder flanges are chipped; they are slotted out in a slotting machine with two tools. The top tool cuts during the downward motion, and the second tool below slots out the flange at the other end of the cylinder during the up-stroke of the machine. Any burr, or slight tear, is thus towards the inside of the cylinder, and the exterior of the flange then merely requires to be draw-filed. In common with all the other details which have to be fitted to the outside of the boiler, the bottoms of the cylinders are carefully planed to the arc of the outside of the boiler-shell. The work is fixed on the bed of a planing machine, the tool of which is made to travel radially in a portion of a circle of the same diameter as the boiler. All chipping is thus done away with, and what is a most expensive job by hand is done by a machine. The planing machine is made to do this job by means of a contrivance uniting simplicity and efficiency in a degree that amounts to a stroke of genius. The tool-box is attached to a bar above, swinging in a centre like a pendulum. The tool-box—fed horizontally along the cross-slide of the machine in the usual way—is constrained to gradually traverse in the arc of a circle determined by the length of the attachment of the bar from the centre pin above. The various lengths of the bar are adjusted in a vertical slide at the top. The stuffing-box glands are slotted out in a machine, while being exactly traversed underneath by means of a contrivance similar to that of a copying lathe. The slide bars are accurately drilled and fitted to a special bracket. The use of special brackets and chucks for drilling, tapping, turning, and planing is a most efficient means of obtaining good and cheap workmanship; it is a means too much neglected in some quarters. All the machine and engine cranks, as they are turned in the lathe, run in an eccentric steadying head; any jar is thus prevented. We noticed a very fine lathe—made in Leeds to a special order of the firm—of such a size that a 12 ft. fly-wheel could be fixed, and turned up on the face plate. The shafting of the turning and tools, and other straps is carried in a remarkably efficient, elegant, and, as we think, original manner. The main shaft is supported on a bearing in the centre and on the top of a handsome column. The counter shafts on each side of the column are supported on arms, carrying a wooden plank in the usual way. When we say that these columns are elegantly shaped, we do not mean that they are furnished with vulgar and hideous ornaments (!) like the large pillar, for instance, supporting some gas lights in front of King's Cross station. We mean that they are formed with neat and flowing lines, and without any of those abrupt breaks in the continuity of outline, so displeasing to any one cursed with good taste. In this part of the works, we counted 60 lathes, 9 slotting, 9 screwing, and 10 shaping machines, as also 20 drilling and 7 boring machines, 3 planing and 3 nut-shaping machines, besides one wheel cutting, one filing, one centering machine, and several other tools. All the working drawings are varnished, stretched on frames, and carefully kept in a particular store furnished with a long rack. Each drawing is numbered, and has its own particular place in company with its companion detail drawings of the same class of engine. The two turning shops are each 110 ft. by 56 ft., with galleries for the fitters. About 120 turners and 140 fitters are employed in this part of the works. The engines being put together in the erecting shop, are shifted about by means of a powerful travelling crane. Every engine, on being finished, is carefully tested on the friction brake. This is not merely the case with the portable engines—five of which are generally tried at a time under a shed—but also with all the fixed engines. The latter are adjusted on a strong wooden framing, placed under the steam-pipe feeding one of the shop engines—a connection being formed with the engine to be tested by means of some gas-piping. The work of the erectors is thus subjected to a thorough practical test, before leaving the shop. We do not believe that this complete system of testing the work is adopted at any other agricultural engineering establishment in England. Judging by the number of men employed, the coal burnt, the oil consumed, and the expense of the general arrangements for testing the engines, we should say that Messrs. Clayton and Shuttleworth spend at least £2,000 per annum in this department. When engines are erected by piece-work, such a system is the only means of obtaining a complete check over the men. We noticed, among the engines over the testing pits, a portable one for irrigating some of the cotton districts in Egypt. Two force-pumps were worked by a double crank shaft parallel to the axis of the boiler. The engine could be easily adjusted for ordinary purposes by disconnecting the gearing driving the crank-shaft of the pumps. Several portable engines working Appold's centrifugal pump are also being constructed for irrigating some land for the Pasha of Egypt.

The large smithy is a very fine shop, 180 ft. by 80 ft., and lighted from the top. About 100 smiths are now working overtime at 56 fires in all. The hearths are not provided with the usual iron hoods now so fashionable—a happy thing for the men during the hot summer of this year. Brick hoods, of course, do not radiate the heat so much as those of iron. It has sometimes occurred to us that the ordinary plate-iron hood might be turned back and partially filled with water, in order to prevent the usual radiation of heat so uncomfortable to the men. The perfect organization of the machine tools enables a complete adoption of the modern system of forging in blocks; thus reducing the expense of the smith's-work, while leaving more to the cheaper work of the machine tools. The engine cross-heads are thus first forged in the shape of a simple cube; then slotted out, and finished, on a special chuck, in the lathe. Four steam-hammers were at full work.

We were greeted with the usual din on entering the boiler shop—a noise, as is well known, literally deafening in its effects on all old boiler-makers. We counted 2 plate-bending machines, 4 drills, and 4 punching and shearing machines in this shop. One of Garforth's steam-rivetting machines is in full work, for rivetting up the flues and shells of stationary boilers and the barrels of portable engines. Perhaps, in course of time, some enterprising tool-maker may make a machine capable of closing every rivet in a boiler; and the dull thud of the steam-rivetter will then supersede the noisy clatter of the hammer. During the erection of the high tower for the reception of the crane holding the flues up to the rivetting machine, a man, now at work in Lincoln, actually fell from the top to the bottom—a distance of more than 50 ft.—with scarcely any injury. He fortunately alighted on a soft part of his body, which thus—buffer-like—broke the fall. Some flush boilers were being made for traction engines. We were informed that the firm lately constructed several fire-boxes of steel, which they had to replace with fresh ones of iron. The steel was found too brittle, especially at the tube plates.

The iron foundry is a large shop, 106 ft. by 75 ft.; with two five-ton cupolas; casting enough iron from 100 moulders (men and boys). Only twelve pattern-makers are employed—a strong testimony to the demand for the well-known staple productions of the works. The six cranes are all fixed against the two opposite walls. It is worthy of note that a particular mixture of different irons is melted for the cylinders; being run into pigs and used as required. This is the only way to get a good silver-like metal for a cylinder, and it is a plan also adopted at the Gorton foundry, Man-

chester. There are also a brass foundry and a malleable iron foundry. The malleable castings are cast from common metal; but are then baked in a material appearing to be principally composed of hematite iron ore. The entire operation lasts from five to six days, and the castings are kept a portion of the time at a dull white heat. They are then cleaned in a machine similar to those used for taking the rust off scrap iron. Clayton and Shuttleworth were the first to make Goucher's beater of malleable cast iron—the inventor himself having used an impracticable arrangement, consisting of a bar wound round with wire.

The manufacture of thrashing machines has quite distinct features from those of engine-making. It requires more special skill, and a thrasher is a more complicated machine. Almost any petty engine-maker can fit up a small engine, which will do its work in a tolerable way, even if it does show a voracious appetite for coals. The experience required to make a good thrashing machines, is undoubtedly more uncommon. We believe it to be generally acknowledged that Messrs. Clayton and Shuttleworth turned out the first really practical thrashing machine. The division of labour and the employment of special machinery is carried out almost as completely with these wooden machines as with the iron engines. A very complete collection of wood-working machines are in full employment. In fact, almost all the woodwork details are done by machinery; hand labour being of course employed to erect the machines. Two of Messrs. Greenwood and Batley's copying lathes cut out the whippletrees, shafts, and wheel-spokes for the thrashing machines. Another machine shapes out the cylindrical ends of the spokes. We also noticed a band-saw, a planing machine with a horizontal spindle, a planing machine with vertical cutters, and several other wood-tools; all from Messrs. Worssam, of Chelsea. A table, fitted with vertical revolving cutters, is used for shaping and boring out the felloes of the wooden wheels. The thrashing machine erecting shop is 40 ft. wide by 320 ft. long, and 200 "machine wrights" are therein employed. Fourteen machines were being made. A large collection of oak and teak for the framing, and of ash and other wood, is kept in seasoning for years before being used. The value of the timber thus stored is estimated at several thousand pounds. A great number of Hayes's straw elevators are made by the firm. Hayes's elevator consists essentially in a large wooden trough, about 4 ft. 6 in. wide, traversed by an endless band armed with iron spikes, carrying off the straw as it leaves the shakers of the thrasher. Campain's straw elevators are also occasionally made. More than a thousand thrashers have been already here fitted with Bruckshaw and Underhill's elevator. The firm has introduced an additional small fan to the delivery tube of this apparatus, in order to aid the cleaning action of the elevator blast. Clayton and Shuttleworth are the proprietors of "Coulson's patent hangers"—consisting of ashen springs, to which are suspended the reciprocating parts, such as the riddles. Experiments with steel suspension rods, attempted to be used for the same purpose, were at the outset tolerably successful; but the first frost caused them to snap. Coulson's ashen springs are also used to communicate motion to the riddle. We noticed the new beater now used by this firm instead of Goucher's. The beater plates are grooved with lines running in a direction parallel, and at a pretty quick angle, to the axis of the beater. Many of the thrashing machines are sent out with gutta-percha bands, furnished by the Company of that name.

Several new workshops are in course of construction—namely, a shop for lagging and painting the engines, and another for painting the thrashers. A covered station is also being built over the branch line from the Great Northern.

In conclusion, we may express a hope that our readers will have derived from the above imperfect account, some of the pleasure we experienced during our stroll through these well-arranged works; a pleasure greatly heightened by the courtesy with which we were received by everybody—from Mr. Joseph Shuttleworth himself (the managing partner), to the humblest labourer.

AMERICAN TORPEDOES.

Some days since, says the *New York Herald*, the enemy made a systematic effort to blow up and destroy the gunboats and transports in Stono Inlet by means of torpedoes. Fortunately, no serious damage was inflicted upon any of the vessels by these infernal machines of destruction; but the escape was quite narrow enough for comfort. One torpedo exploded a little astern of the "Pawnee," and blew her launch, which was towing astern, to fragments. A few moments later a tremendous explosion occurred on Bird Key, a few rods below the "Pawnee," occasioned by another torpedo sent down at the same time. From facts since developed, it is certain that the rebels sent down on that night at least ten of these inventions of the devil, three or four of which exploded, and four of which were picked up. One drifted through the fleet of transports and up the Folly River, and exploded under the bows of the mortar schooner "C. P. Williams," but occasioned no damage. The torpedoes are precisely like those we have found in the Light House Creek, and go off at the slightest concussion. The method adopted in sending them down and securing results is rather ingenious. The boat picked up in the Stono the day after the explosions occurred was fitted up for torpedo business. It had a long and wide plank fastened across the gunwales, upon which the torpedoes were placed. From certain marks upon the plank it was evident that ten of the machines had rested upon it. The torpedoes are launched upon an ebb tide and sent down in pairs, connected by a rope 50 ft. or 60 ft. long. On each of the machines a rudder is attached —one fastened hard a-port, the other hard a-starboard. By this means the bows of the torpedoes have a tendency to move on divergent courses, and the line is straightened out. As they float down the tide, the anchor chain of the vessel which is to be destroyed, catches the rope about in the middle, and the torpedoes are borne down the current to the length of their cable, when they swing around and strike the side of the vessel. The concussion explodes them, and the natural consequences attending the explosion of 80 lb. of powder under a vessel follow. They did not work in the instance referred to, but they may yet do damage. Precautions have been adopted to prevent any serious damage to the vessels from further visits of those devilish inventions of the enemy.

THE COMBINATION SYSTEM OF SHIP-BUILDING.

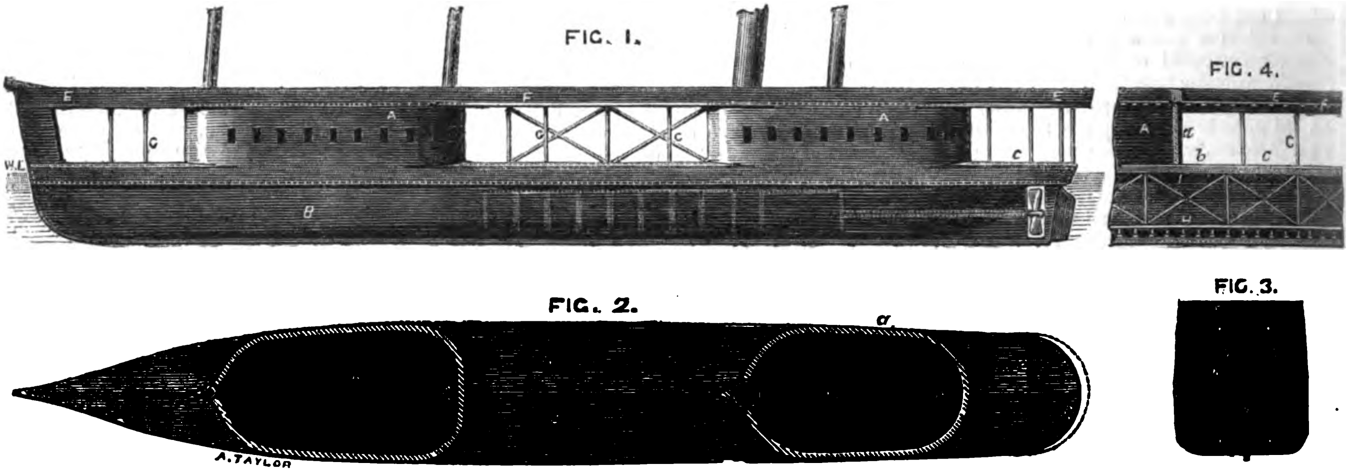
Shipbuilding in this district, says the *Newcastle Chronicle*, has reached of late a new phase in its progress—an attempt to secure all the advantages of wood and iron by combining these two materials in the construction of merchant vessels. This system, though practised in the Thames, the Clyde, and the Mersey, is comparatively new to this district, for, if we mistake not, Sunderland is the only one of our northern shipbuilding ports where it has been brought into practical use. It is somewhat to be regretted that the shipbuilders of the Wear took no pains to bring this subject before one of the sections of the British Association, with a view to discussion and comment. Although a proportion of "the wise" who went over to Sunderland had an opportunity of inspecting vessels built on this principle, the bulk of our learned visitors had not the opportunity; and therefore, we may be excused the reproduction in these columns of some account of the system.

It was first introduced on the Wear by Messrs. G. S. Moore and Co., and afterwards adopted by Mr. Peverell, those two firms continuing to build exclusively on the combination principle. Mr. James Laing and other builders of iron vessels, who possess the necessary machinery, also build on this principle when required. As to the mode of construction, we take the description of Mr. Moore's plan, which is this:—The keel is of wood, and laid in the usual manner, while the stem and sternpost, also of wood, are fastened thereto, precisely as in a wood-built ship. The framework is of iron, like that of an ordinary iron-built ship, and its component "ribs" are all rivetted into an iron plate on the keel. This plate is of sufficient width to take in the garboard strakes, which are bolted through the keel, and also through the plate and frame. To secure greater strength for this framework of iron, it is trussed on the outside with flat iron bars, extending from the keel plate to the sheer strake, these bars being placed diagonally, 5 or 6 ft. apart, and rivetted to each frame. The beams are also of iron, fitted in their places, and secured to the frames by stringer plates and angle iron. A strong and rigid skeleton of iron having been thus produced, the next operation is to clothe it with a waterproof skin that will best enable the ship to resist the power of the element in which she finds her future home. The combination builders eschew, for various reasons, the system of iron-plating, and adopt the planking of teak or other wood, half an inch thicker than the thickness required by Lloyd's for a wood-built ship. This planking is fitted to the framework and diagonal trussing, and secured to the frames by bolts of yellow metal driven from the inside, and clenched upon rings of the same metal upon the outside plank. The vessel can be then coppered to prevent fouling, and finished in the style of ordinary timber-built vessels.

The great lightness and buoyancy secured by this mode of construction, as well as the economy of internal space by the substitution of iron for the thick and massive framework of timber-built ships, must be evident to every one. The corrosive action of moisture in this combination of wood and iron, which at first formed a difficulty in the way of combination building, is now entirely obviated by coating the iron and leaving the framework, internally, quite uncovered. Thus a free current of air passes over it continually, and it can be painted as often as necessary to ward off oxidation. The more serious difficulty of galvanic action between the copper fastenings and the iron of the framework, has also been overcome by the plan patented by Messrs. Moore. Each copper bolt is furnished with a collar of an incorrodible composition. This capsule being then soldered to the collar, the bolt becomes hermetically sealed, and safe from external action. The adoption of iron framework also relieves the shipowner from the dread that dry-rot may attack the internal timbers, and the shipbuilder from the difficulty, so frequently experienced, of obtaining good beams for first-class ships and crooked timber for frames. Moreover, there is no shape, or curve, or angle, that iron framework may not very easily be made to assume.

The disadvantages of timber-built ships are, the frequent liability of the frame-timber to rot, and consequent great expense of repairs, and the loss of internal space for cargo through the thickness of the timber in the vessel's framework. The undoubted value and advantages of iron ships are counterbalanced somewhat by their liability to internal oxidation, and by the infinitely greater obstacle presented by the fouling of the bottoms which obviates the fast-sailing properties which they would otherwise possess. An advantage in all these respects is claimed by the combination system. Objectors may doubtless be able to point out defects and weak points, but the great question is, which of the three systems can claim to possess the fewest of these; The recognition which the combination system has already received, augurs well for its more extensive adoption when it becomes better known and its merits are inquired into. The fact of its including the internal economy of space—the great advantage of iron ships, and avoiding by means of copper sheathing their great defect, are important points in favour of combination. There is no doubt combination ships will be much valued until the prevention of fouling on iron hulls can be accomplished, for it is well known that an iron steamer which has been a short time at sea cannot cope in point of speed, with copper-bottomed wood vessels such as the "Alabama." Rapidity of construction, and the fact that the planking can be as easily caulked and repaired as that of wood ships, are further advantages claimed for the new system; while combination ships are also said to hold together better when stranded, and thus afford to sailors and passengers a greater security of life than iron ships which (as in the case of the "Royal Charter") break up rapidly.

CLARK'S ARMOUR-PLATED SHIPS.



CLARK'S IMPROVEMENTS IN ARMOUR-PLATED SHIPS.

The following improvements in armour-plated ships have been recently patented by Mr. W. Clark, engineer, London:—According to this invention, war-ships are built having the main body or continuous part of the hull but little above the load line, say, some 3 ft. or 4 ft., or it may be only to the load line; so far the mould of the ship is much as in ordinary; from this level the hull of the ship is carried up in sections, say, in two sections or parts (for a ship 400 ft. in length) of about 100 ft. each in length, the one part commencing, say, some 30 ft. or 40 ft. from the stem, and the other about 20 ft. from the stern. The part of the lower body unoccupied by these raised sections or structures will be a kind of deck, which is covered over with strong iron plates to give the necessary strength to the hull and to resist the force of exploded shells or the graze of shot, to which alone it would be subject, being nearly or quite horizontal. In building these vessels a light upper deck may be carried over the entire area of the ship, which deck is carried between the raised parts of the hull on girders stretched from the one to the other, and if necessary supported by pillars from the exposed plated deck below. Besides covering the raised parts of the hull with armour plates, the patentee covers the main body from end to end with armour plates, say, to the required depth of 5 ft. below the water line and over the whole of the lower part of the hull rising above water, which may be to the extent of 2 ft., 3 ft., 4 ft., or even 5 ft. For a ship of five or six thousand tons burden a saving in the weight of armour-plate to the extent of some 400 to 500 tons will be effected. The high parts of the sides are alone pierced for guns.

Fig. 1 represents, in side view, an armour-plated ship constructed with the upper and flush deck.

In this illustration are represented two gun-chambers A, as rising up from the lower part of the hull B, B, but their number is not imperative, and they may be otherwise disposed—that is to say, they may be further forward or aft, or of larger or smaller dimensions. If greater buoyancy is required at the bow, for instance, it may be advisable to place the fore chamber farther forward, or it may be better still to enclose the forward open part of the ship, but which it is preferred to do in light framing and plates easily penetrable by shot and shell, from the effects of which the ship would be protected by her plating.

Between the part B and the gun-chamber the upper deck E is supported on girders F and pillars G, as also between and aft of the gun-chambers; these may be further strengthened by longitudinal and transverse diagonal stays, as seen in the side view and cross section. The gun-chambers A may, of course, be pierced for a greater or lesser number of guns, according to the capacity or requirements. The rudder-head entering the vessel below the water line will require to enter through the stuffing-box, and may be worked below the open deck C, or the steering gear may be carried forward and up to the upper deck E, within the after gun-chamber. Fig. 3 represents a midship section of fig. 2, and fig. 4 a partial longitudinal central section of the same.

In order to prevent the sea washing over the upper deck, it may be necessary to carry the deck much higher from the water line (say 25 ft. or 30 ft.) than in ordinary ships, but for which this form and construction of ship will be readily capable, as having less weight above the water line, and being less subject to rolling motion than vessels of an ordinary build.

LOCKING-UP FORMS OF TYPES.

The following improvements in printers' chases have been recently patented by Mr. Robert Ward, of Newcastle-on-Tyne. The invention has for its object improvements in locking-up or fastening forms of type or other printing surfaces. For these purposes, in place of employing loose wooden wedges acting on side-sticks or foot-sticks, as heretofore, a long wedge of any suitable material, by preference in one piece, but this is not essential, is placed between two foot-sticks or two side-sticks, and such wedge is set up by a screw, which is formed with a head having holes therein by which it can be readily turned whilst in the chase, in which the "form" of type or printing surfaces is required to be locked-up or fastened. The head or outer end of the screw rests against a block, whilst the screw itself enters a female screw formed in the larger end of the wedge; hence, when the screw is turned, it will force the wedge more and more in between the two foot-sticks or the two side-sticks so as to cause them to separate, and thus lock-up or fasten the "form" in the chase.

BRITISH ASSOCIATION.

Mathematical and Physical Science.

LADD'S ELECTRO-MOTIVE ENGINE.

The electro-motive machine exhibited and described by Mr. Ladd consisted of two coils forming a powerful electro-magnet, revolving on an axis parallel to the axes of these coils, and at equal distances between them. On the stand, four pillars, forming coils, were planted in the circumference of a circle round the revolving electro-magnet, and at such a distance from it as to permit its free motion. By a simple contrivance, similar to the commutator, the electric current was so transmitted and reversed as to make each of the pillar coils a magnet, with the pole it presented to that of the revolving coil as it approached it, of the opposite name, south or north, but the instant it passed, reversing it into one of the same name; thus, while advancing, it is attracted, but, the instant it begins to retire, repelled; and so a constant motive force is applied to keep it revolving. The engine exhibited was mounted with bevel wheels, carrying an axle, on which a cord could wind up a weight of some pounds. It was also furnished with a friction brake, by which its power, which was, even with only two Grove's cells, considerable, could be exactly measured.

ON THE ELECTRICAL RESISTANCE AND THE ELECTRIFICATION OF GUTTA PERCHA AND INDIA RUBBER UNDER VARYING PRESSURES, EXTENDING TO 300 ATMOSPHERES,

By Mr. C. W. Siemens.

The pressures were produced by a powerful hydraulic press. Mr. Siemens found, by experiment, the resistance of gutta percha, or, in popular language, its insulating power, increased as the pressure increased, and the rate of increase was found to be greater the higher the pressure. At 300 atmospheres the resistance was nearly three times that observed at atmospheric pressure. When the pressure was removed, the resistance immediately fell to nearly its original amount, and, after some time, regained the original resistance exactly. The resistance of india rubber, on the contrary, was found to decrease with an increase of pressure, but the rate of decrease tended to become constant; when the pressure was removed, a kind of rebound occurred, for the resistance immediately rose to more than its original amount, but, after some time, again fell to its first condition. It might be thought that this effect in india rubber was due to the introduction of water into its mass under high pressure, whereas gutta percha might be supposed to resist this kind of percolation. This view was, however, shown to be untenable; since, when a wire was first covered with india rubber and then with gutta percha, the change of resistance due to the increase of pressure was a mean between the results obtained with gutta percha and india rubber separately. The effect on the apparent resistance of the insulators by continued electrification, first published by Mr. Fleeming Jenkin at the Aberdeen Meeting of the Association, was next alluded to. Mr. Jenkin found that the decrease of the current passing through the gutta percha, due to electrification, was constant at all temperatures, and independent of the change of resistance due to this cause. Mr. Siemens had found the same result with the change of resistance due to change of pressure.

DAWES'S SOLAR EYE-PIECE.

Communicated and exhibited by Dr. Lee.

Mr. Dawes has introduced his admirable solar eye-piece, which possesses the advantage of being applicable to any existing telescope. The solar phenomena are, therefore, more within our ken than formerly as to their shape and habits, or successive changes, and particularly as to their effects; but their physical constitution remains unfathomable, like the question, Whence come the perpetual beams of light and heat of the orb itself? Yet these particulars, the theme of endless plausible cogitations and ingenious suggestions without proof, though still among the unrevealed mysteries of nature, may finally submit to unremitting researches. For instance, the solar spots can now be safely pro-

nounced to be no longer an object of idle curiosity, like the casual clouds of our atmosphere. The few landmarks hitherto recorded begin to indicate a regular progress of position in them, with periodical maxima and minima in their amount. Thus, in the years 1845-46, the groups of solar spots extended to about 40 deg. north of the Equator, and to 30 deg. [illegible] it, leaving a central blank band from 8 deg. [illegible] 5 deg. south. This state of arrangement is [illegible], with the exception that the prepon-[illegible] present on the south side of the [illegible] in 1853 and 1854, the spots were distri-[illegible] deg. north to about 20 deg. south, de-[illegible] till early in the year 1856, when [illegible] minimum, and the equatorial [illegible] clear; but spots appeared in both [illegible] 20 deg. to 40 deg. Their parallels are [illegible] contracting. So much for their [illegible] for their *motion*. Their daily drift in [illegible] a general equatorial current 30 [illegible], in the direction of the rotation, and [illegible] of nearly the same breadth is [illegible] beyond it, in each hemisphere. In the [illegible] we are greatly indebted to Mr. Ca[illegible]; but now we must turn to Major-[illegible] Sabine, with thanks for the light that he has shed on the mysterious correspondence between the solar and the terrestrial magnetic disturbances; for a decennial period is therein indicated, as well as another connected with the earth's orbit, which brings us to the present wondrous result of well-directed investigation. Every inquiry which leads to our information respecting the physical condition of the great centre of our system is of the highest scientific value; and as there is some danger to the eye in closely watching the solar spots, faculæ, luminous stata, and other phenomena under a hot glare, every invention to prevent injury while scrutinising the sun is both useful and valuable. Urged by necessity, the Rev. Mr. Dawes planned an eye-piece which, under his direction, was constructed by Mr. Dolland. Its peculiarity consists in having a metallic slide, with perforations of different sizes, which crosses the eye-tube at right angles, just at the focus of the object-glass; and though the slide is greatly heated while viewing the sun, the conduction is cut off by interposing a plate of ivory. The pe[illegible] vary in diameter from 0·5 to 0·0075 of an [illegible]. Moreover, as observed in the "Speculum Hartwellianum" (p. 28), this admirable eye-piece possesses the advantage of being applicable to any existing telescope. The indefatigable inventor has now constantly used it during a period of upwards of ten years, with success, and most interesting results, as to a stratum on the solar disc, and the rotation of a remarkable spot through an arc of 100 deg. in six days! Solar investigations are, therefore, more within our reach than formerly, especially as photography and practical philosophy have brought their powerful aid to bear on the investigation.

Prof. Phillips, after acknowledging the value of the ingenious invention of Mr. Dawes, described the method by which the eminent optician Cooke had succeeded in separating the heat of the solar rays from the luminous portion before their arrival at the focus. The eye-piece constructed by him was a prism of 45 deg. and a right angle, with one of its faces presented to receive the light after leaving the object-glass; the luminous rays are then received on the back of the prism at a larger angle than that of total reflection, so that fully 95 per cent. of them are thus got rid of. By this simple contrivance the utmost comfort is secured to the observer engaged in examining the sun.

Mechanical Section.

DISCUSSION ON THE REPORT OF THE COMMITTEE ON GUN-COTTON.

Sir Wm. G. Armstrong said it was impossible to listen to the report which had been read without being very much impressed with the great promise there was of gun-cotton becoming a substitute for gunpowder; but at the same time there were certain peculiar anomalies about it which he certainly should like to have cleared up, and until they were, they could not feel that perfect confidence in the results that they wished to do. In the first place, with regard to the heat evolved, they were told that, with such a quantity of gun-cotton as would produce a given quantity of gas, a certain initial velocity was imparted to the projectile, and that the heating effect upon the gun was much less than when a similar velocity was produced by an equivalent quantity of gunpowder. The absence of heat in the gun implied an absence of heat in the gas. Where was the projectile force to come from, if there was no heat in the gas? He could not, for his part, conceive how it was possible of explanation. The next point that occurred to him was with regard to the recoil. It was stated that the recoil was very much less. That was ascribed to the absence of solid inert matter in the charge, which, in gun-cotton was next to nothing. If the recoil was only two-thirds that of gunpowder, it would require, in order to account for that difference, a much larger quantity of solid matter than there really was in the case of gunpowder. The report stated that the use of gun-cotton enabled them to reduce the length of the gun. It was quite certain, however, that with a short gun they could not get an equal initial velocity as with a long gun. If the initial velocity were increased there was more danger of bursting the gun than with gunpowder. Because if they got any velocity, or an equal velocity with the shorter gun, it must be concluded that it was done by virtue of a greater initial pressure and an earlier action upon the shot. That necessarily implied a greater strain upon the gun at the first explosion, and that would necessitate the employment of stronger guns. He should have expected a smaller velocity by a shorter gun, for the action of the gas was necessarily shorter than in a longer gun. The heat question, however, was to him the greatest puzzle of all. How they could have the propelling power without heat in the gas, and if they heated the gas, how they escaped heating the gun, he could not understand.

Professor Pole said he was quite unable to give any explanation of the difference of recoil. If the shot left the gun with the same velocity as when fired with gunpowder, it was natural to suppose that there must be the same quantity of recoil.

Mr. Siemens having briefly spoken on the dynamical question involved in the matter, suggested that the greater heat imparted to the gun in the case of gunpowder might be owing to the greater amount of solid matter, which taking up the great heat of the gases under a pressure of some 400 atmospheres imparted a portion of the same by radiation to the side of the gun; while in the case of gun-cotton gases only were produced, which could only impart heat to the gun by the slower process of conduction, and left a larger margin of heat to be developed in force by expansion.

Admiral Sir E. Belcher thought that the reason the gun was not heated by an explosion of gun-cotton might be because the gases had not time to heat the gun owing to the rapidity of the explosion, which was slower in the case of gunpowder; or that it might arise from the greater amount of fouling in the case of gunpowder.

Capt. Maury said this report was something more than interesting, because it was so exceedingly suggestive; and it appeared to him that it afforded them an element of security by giving the preponderance on the side of defence. Ever since steam had been applied to purposes of naval warfare, it had been considered a matter of very great doubt by many professional men how far ordinary steamers and men-of-war, where forts were to be passed at the mouth of a river, were capable of sustaining the fire of such forts and passing up the river. And to show that there was ample time for them to do so, they had only to recollect the fact of steamers having fought forts for several hours. In the Crimea and at Charleston the steamers had remained under fire for several hours—a much longer time than was necessary to enable them to pass the forts and go higher up the river into a place of safety where they could do damage to the enemy. Iron-clads had rendered this much more easy than it had previously been. If then their principal defences failed them at the mouth of a river in this way, the question was whether they should not have recourse to mining for the destruction of the invading vessels? He himself had been engaged upon the subject. He found this difficulty in employing gunpowder, that in order to be sure of destroying the vessel as she passed in a given line by means of gunpowder, the magazines must be in actual contact, or very nearly in actual contact with the side of the vessel; otherwise the probability was that the vessel would not be destroyed. Last week they had the intelligence of a vessel having had a mine exploded under her on the James River. That magazine contained several thousands of pounds of powder. The vessel did not know that the mine was there; but the mine did not destroy the vessel. It merely threw up a column of water, which washed some of the men overboard. His own conclusion was that to make sure of destroying a vessel after she had passed the forts, they must mine the channel in such a manner that the vessel must come in contact with one or other of the mines. It was found that wooden vessels to contain the powder would not do. They would not confine the powder long enough to produce a sufficient force. It was necessary to make them of stout boiler-iron. It would not do to leave the magazines on the top of the water, and it would not do to put them at the bottom, for then there would be a cushion of water between the bottom of the ship to be destroyed and the magazine, which would protect the vessel. In short, they had to anchor them beneath the surface with short buoy-ropes, at a depth proportioned to the kind of vessel expected to come up. But when they made the magazine of boiler-iron they had to have buoys to float it so large that they were always in danger of being carried away by the vessels crossing the line of magazine. The plan was to place those magazines in a ring in such a position that the vessel in passing would have to come in contact with at least one and probably two of them. It was necessary to place those magazines of powder so that when you saw the vessel in that range you had only to bring the two poles of the galvanic battery together and make the explosion. There was, as already stated, a difficulty in using gunpowder. But since gun-cotton had the remarkable effect of destroying a vessel—he did not know her strength—at a distance of 18 ft., and that not vertically, but laterally, the question arose whether they might not fortify and protect those channel ways by placing a ring of gun-cotton magazines along the bottom; but, at any rate, if that was not necessary, they could float them at any depth, and out of reach of the vessels generally using the channel. That appeared to him to be one of the most important uses of gun-cotton, and it was one which would give safety to cities which were some distance from the mouths of navigable rivers. He trusted that in the event of the Committee continuing their labours, they would address their attention to this important point.

Admiral Sir E. Belcher stated that the explosion of powder under water was once done under one of his own vessels to clear away ice. He placed it upon the ground, thinking that its explosion would blow the ice clear of her bows without touching the vessel. There was, however, sufficient water to form a cushion, and when the explosion took place it only produced a great wave upon which the vessel rose.

Professor Pole said what they wanted was something to show the varying pressure of the gases in the gun; in fact, an indicator diagram.

Mr. J. Scott Russell set himself to clear away the many difficulties which attended this very difficult subject. How was it that in gunpowder and in gun-cotton where there were equal quantities of gas put in, the gas in the case of gunpowder was raised to an enormously high temperature, and came out at an enormously high pressure, showing that they had gas enormously expanded by heat; whereas in the case of gun-cotton the gas came out quite cool, so that you might put your hand upon it, and the gun itself was quite cool? He (Mr. Russell) had a theory. Steam was a gas, and steam expanded just by the same laws as other gases did. A great deal of the gas of gun-cotton happened to be steam. Let them conceive 100 lb. of gun-cotton shut up in a chamber that just held it. They had got there all the gases that had been spoken of, but they had also got 25 lb. of solid water—about one-third of a cubic foot of water—in that chamber. What did they do with it? They put fuel, they put fire to it. They heated the whole remaining pounds of patent fuel. If, then, they considered the gun-cotton gun as the steam-gun, they got rid of two difficulties. They would have, first, the enormous elasticity of steam; and, secondly, they would get the coolness of it. They all knew that if they put their hand to expanded high pressure steam, it had swallowed up all the heat and came out quite cool. He believed that the gun-cotton gun was neither more or less than Perkins's old steam-gun with only this difference, that you bottled up the fuel and water, and let them fight it out with each other. They did their work and came out quite cool. He hoped, however, that it was understood that he did not dogmatise. He put all he had said with a note of interrogation upon it.

Prof. Tyndall said he thought that a note of interrogation ought to be put to what Mr. Russell had said.

Copper ore of a rich quality has been found in British Columbia. A vein of native copper has been discovered within ten miles of Victoria.

HUGHES' IMPROVEMENTS IN TELEGRAPHIC APPARATUS.

These improvements, recently patented by Mr. D. E. Hughes, electrical engineer, Old Broad-street, City, relate—1, to means for regulating or governing the motion of apparatus employed when recording telegraphic communication. Upon one of the main axes of such apparatus the patentee applies a fly or balance wheel, and opposite the end of this axis, but held somewhat inclined to it, is fitted an elastic and weighted rod capable of vibrating in a rotary direction when acted upon by an arm or connection from the main axis referred to. The vibrations thus obtained regulate and render uniform the motions of the apparatus without the necessity of an escapement. The position of the weight on the vibrating rod is capable of being regulated to the speed desired. To prevent breakage of this vibrating rod by the extent of its vibrations, a pad or friction surface is brought into operation upon a friction band or surface as the vibrations increase, in order to use up the surplus force exerted.

The improvements relate—2, to means for facilitating the ready change from one class or character of recorded sign or indication to another, as from letters to figures. For this purpose the periphery of the type wheel is arranged with the desired different signs thereon in alternate order, and this wheel is affixed to a hollow shaft or boss which receives the hollow shaft or boss of a correcting or adjusting wheel, having teeth on its periphery corresponding with those of one set of signs on the type wheel, or the intermediate positions thereof. The outer end of an arm from the axis of the type wheel passes into a recess in a lever turning upon an axis carried by the correcting or adjusting wheel, and this lever is formed at its opposite ends with projections adapted respectively to fill up spaces opposite those between teeth of the correcting or adjusting wheel. The pressing in of one end of this lever will cause the teeth of the correcting or adjusting wheel to be coincident with one set of signs on the type wheel and the pressing in of the opposite end of the lever causes the type wheel to be moved partly round on its axis, so that intermediate signs are then coincident with the teeth of the correcting or adjusting wheel. One or the other end of this lever is pressed inwards at the times desired to effect a change, when the apparatus is set in motion by the passage of a current of electricity brought into operation by acting on one or the other of particular keys corresponding with the relative position of the type and correcting or regulating wheels.

The improvements consist—3, in connecting the armature of an electro-magnet, through a small local battery, to one wire of the electro-magnet, and in connecting the other wire of the electro-magnet with a stud or projection in position to be acted upon by the armature when that is raised. By these means, upon the passage of a current of electricity into the electro-magnet, the armature is at once released, when the current of electricity, in place of continuing through the coils of the electro-magnet, flows by way of the armature and through the local battery to the main wire; at the same time, the tendency of the local battery is to restore the magnetism in the cores of the electro-magnet.

These improvements relate—4, to the means of insuring a sufficient flow of electricity for considerable lengths of wire, and when working with high speeds to the type wheel, that the duration of contact of the contact surface employed may be equal to the passage of three or more letters of the type wheel.

Fig. 1, of the accompanying drawings, represents a side view, partly in section; and fig. 2, a plan view of parts arranged according to the first part of the improvements.

a indicates parts of the framing; b, a fly or balance wheel affixed on one of the main axes of the apparatus employed in recording telegraphic communications; and, su posing these improvements applied to apparatus such as described in the specification of Letters Patent granted to Mr Hughes, bearing date the 27th of April, 1858.

HUGHES' TELEGRAPHIC APPARATUS.

FIG. 2.

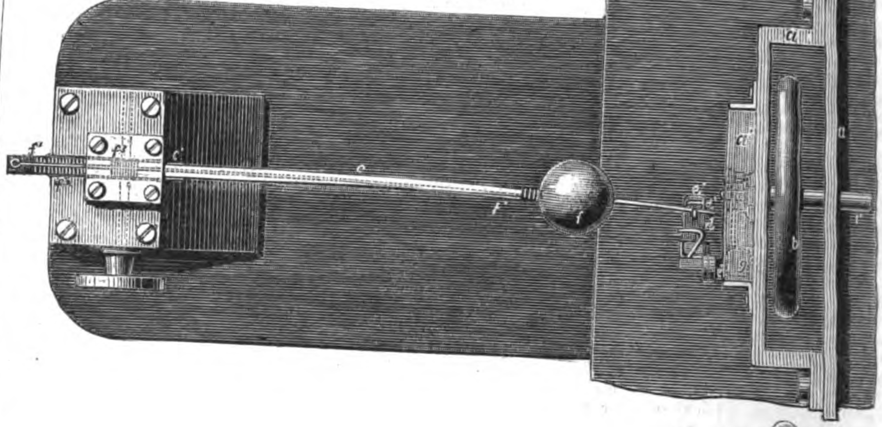


FIG. 1.

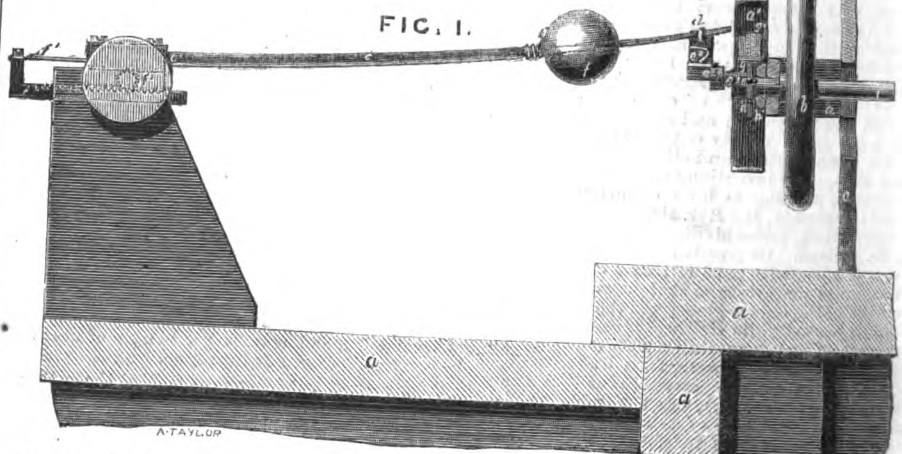


FIG. 5

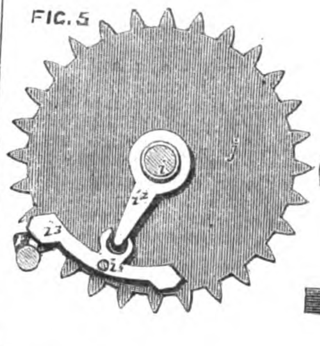


FIG. 3.

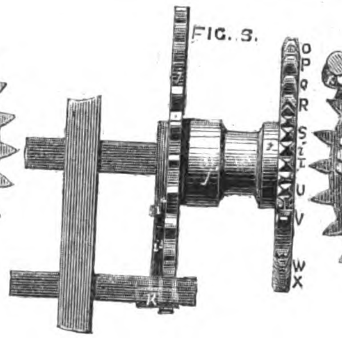
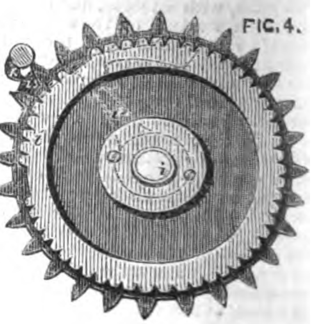


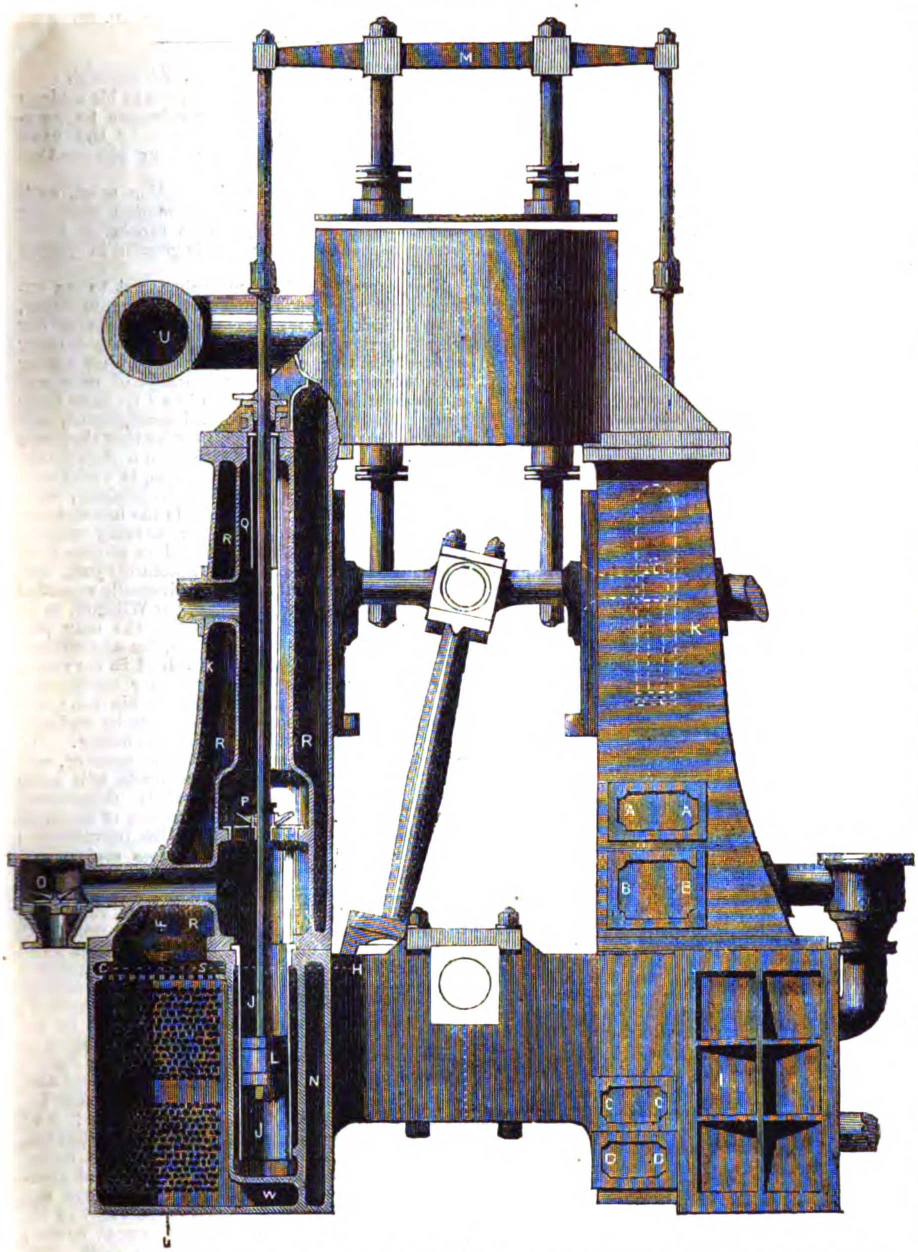
FIG. 4.



No. 938, such fly or balance wheel will represent the fly or balance wheel Z there referred to, as affixed on the axis I^1 of that apparatus, but this may be varied; c is an elastic rod, one end of which is fixed stationarily at c^1, whilst the other end passes through an eye d^1, attached to the piece of thick leather, or other suitable elastic material d, which is affixed to the boss e between the plates e^1 and e^2 affixed thereto, by which the end of the leather d carrying the eye d^1, will, when the apparatus is at rest, lie on the plate e^1, and when the apparatus is in motion the leather d will be restrained by the plate e^2. The boss e carries a pin or axis, which turns in a hole formed for it in the end of the arm affixed to the axis I^1; f is a weight capable of sliding on the elastic rod, and of being held in any desired position thereon by its being affixed to the rod f^1, to which is affixed a rack, the teeth of which are taken into by the teeth of a pinion, by which that rack is moved so as to move the weight f along the rod c. The boss e also supports the arms g and h; the arm g is furnished with a pad g^1 of cloth, leather, or other suitable material, which in the rotary vibrations of the outer end of the rod c is brought to bear against the inside of the stationary rim a^1 affixed to the framing a, and the arm g is drawn towards the flange a^1 by means of the spring h^1 acting on the arm h. By this means, as the fly or balance wheel b revolves, motion will simultaneously be given to the weight f, which, by acting on the rod c, and thence through the strap or band d upon the boss e and the friction arm g, will cause an increase of friction upon that arm, in proportion to the amount of force exerted by the tendency to increase the arc of vibration of the rod c, resulting from any increase of motive power exerted upon the apparatus, by which the effect of such power will be rendered uniform. By altering the position of the weight f along the rod c, the number of vibrations of that rod in a given time will be varied, so as to regulate and render uniform the speed of the mechanism to which it is connected in relation to another or other instruments with which it may be desired such mechanism should work in unison.

Fig. 3 shows a side view, fig. 4 a front view, fig. 5 a back view of parts arranged according to

MACE'S MARINE ENGINES.



the second head of the invention. i is the type wheel, the periphery of which is formed alternately into signs of a different character, as letters and figures, and in place of this wheel being formed on or affixed to the same boss as that to which the correcting or adjusting wheel is affixed, the type wheel is affixed to the tube or hollow axis i^1, which receives upon it the boss j^1 of the correcting or adjusting wheel j. To this hollow axis i^1 of the type wheel i is also affixed the lever or arm i^2, the outer end of which is received into a recess, as shown in the lever i^3, which is capable of moving on its axis of motion i^4, carried by the correcting or adjusting wheel j. The effect of a depression of either end of this lever i^3 towards the centre of the wheel j is to cause the type wheel i to make a slight movement on its axis in relation to the correcting or adjusting wheel j, in a direction dependent upon which end of the lever i^3 is depressed, and the amount of movement thus obtained is equal to the distance between one sign and the next, or from one character of sign to the other on the type wheel, and the depression of one or the other end of the lever is is obtained by causing the cam or tappet k to act at the time desired, in manner described in former specifications.

MACE'S IMPROVEMENTS IN MARINE ENGINES.

THE following improvements in marine engines have been patented by Mr. Charles Mace, engineer, Sunderland. In constructing inverted cylinder steam-engines suitable for driving screw propellers and other uses, according to this invention, the main bed of the engine is formed into a hollow box frame of a suitable form, and of sufficient size to receive the arrangement of horizontal tubes of a surface condenser. In this condenser the tubes are placed horizontally, but slightly inclined, and the tubes in each are disposed in a line with the keel, and consequently with the driving shaft of the engine. It is preferred that the circulation of the condensing water should be by mechanical means and through the thin metal tubes of the condenser, whilst the steam is brought in contact with the exterior surface of such tubes; but this action may be reversed. The condensers form the bed of the engine, and the hollow columns which rise above and are fixed to the condensers form the supports of the cylinders; the air-pumps are formed in the columns that support the cylinders, and are worked from cross-heads either above or below the cylinders; the pump-rods work through suitable stuffing-boxes, as shown in the accompanying drawing, which is a front elevation, partly in section, of a steam-engine, with two steam-cylinders and condensers arranged or combined according to this invention.

I, I, are the hollow boxes or bed plate of the engine containing the tubes, constituting the surface condensers; the tubes in the condensers are arranged parallel to the keel and to the main shaft of ths engine; J, J, are pumps in the columns K, and such pumps descend below the upper surfaces of the boxes I, as shown. The pump-rods ascend through stuffing-boxes, as shown; and such rods may be either worked by a cross-head M above the cylinders, or by continuing the lower cross-head in the manner shown by dotted lines in fig. 1, so as to have the pump rods fixed thereto. The lower cross-head of each steam cylinder gives motion by a connecting rod to a crank of the driving shaft of the engine. The lower cross-head of each steam cylinder is connected to two piston rods of such cylinder, and the cross-head is guided at its ends, as is shown in the drawing; the hollow boxes constituting the bed of the engine are connected by cross-beams which carry the driving shaft of the engine. L, L, are the buckets of the pumps; O, O, are suction valves; P, P, the delivery valves; Q, Q, are air-vessels formed in the upper parts of the columns; R, R, are exhaust passages formed in the columns leading from the steam cylinders to the condensers; S, S, are the exhaust passages into the condensers; T, T, are perforated plates to diffuse the steam into the condensers; U, U, are the steam pipes; V, V, are the foot valves of the air-pumps; W, W, are the passages from the vacuum spaces to the foot valves of the air-pumps; X, X, are the delivery valves to the hot well N, N; and Y, Y, are the circulating water spaces of the condensers; A, A, are the delivery valve doors; B, B, are the bucket doors; C, C, are the delivery valve doors to hot well; and D, D, are the foot valve doors. In working the pumps the down-stroke of the buckets L draw off the water from the condensers. The up-stroke of the buckets closes the suction valve O, O, and forces the water through the delivery valves P, P, and thence into the sea when the engines are used propelling a ship or vessel. In order that the condensers may be used in the event of any defect in the tubes, the patentee introduces ordinary injection apparatus, and then uses the condensers in the usual manner of ordinary injection engines.

THE STEERING SCREW-PROPELLER.

A SERIES of very interesting experiments was carried on last week at Sheerness, by order of the Admiralty, to test the value of a steering screw-propeller applied to the "Charger" gunboat, the invention of Mr. W. J. Curtis, C.E. The peculiarity of this screw is that a ring forming a universal or ball-and-socket joint, is placed within the hollow boss of the screw, which is thereby connected with the main shaft, the centre of gravity of the screw and the centre line of the rudder intersecting the centre line of the main shaft, so that the entire weight of the screw is borne by the shaft; and by means of the tail or spindle of the screw projecting from the boss working in the rudder, whatever may be the movement of the rudder, it communicates an equal movement to the screw, which therefore becomes not only the propelling but also the guiding power of the ship. Furthermore, by this invention the retarding action of the rudder and likewise the vibration are removed, while the speed of the vessel is increased. The "Charger" gunboat, having been handed over to Mr. Curtis for the purpose of making experiments, was on Wednesday taken for trial at the measured mile off Maplin Sands, the result being that the mean of the runs to and fro was 8·698 knots an hour, as contrasted with 7·751 knots obtained at Portsmouth previous, showing a gain of ·531, or about half a mile, in favour of the steering screw, while the indicated horse-power showed 113·30, against 145·25 obtained at Portsmouth. It was felt by those who witnessed the experiments that, had the engines been in a more efficient working state, the gain would have been still more considerable. On Thursday a competitive trial of speed took place between the "Charger" and the "Spanker," twin boats, having been built upon the same model and

lines by the same builders, and each containing engines of 60-horse power. The distance run was from a buoy off the "Formidable," flagship, at Sheerness, round the Nore Light and back, a total distance of about eight miles. In this distance the "Charger" beat the "Spanker" by 17 minutes, being 25 per cent. gain, or equivalent to about a mile and a half per hour, the whole run being made by the "Charger" in one hour and one minute. This gain is evidently obtained by avoiding the retarding effect of the rudder, as it was found that, to keep the vessel in her course, the helm never varied more than from 3 to 5 deg. The full circle was made in 2 minutes 40 seconds, helm starboard 50 deg., the diameter of the circle being 120 ft., measured by a line paid out from the stern of the ship. The circle to port, helm 40 deg., was made in 2 minutes 30 seconds, diameter the same, the length of the vessel being 115 ft. By working the screw astern and putting the helm over 40 deg. the vessel can be turned in about half the time above stated and in a radius of only one-third its length, measuring from the screw itself. The screw can be applied in the dead wood of the ship, and lifted as in the ordinary way, so that the vessel may be governed either by the rudder or screw, or by both, at the option of the commander; also, if found necessary or desirable, the rudder may control the movement of the vessel by the momentum after the engines are stopped; but all that has been sought or could be expected by a first trial is the establishment of the principle of the invention, which is considered to be proved beyond all question. Its value to large ships must be apparent, whether for war or commercial purposes.

A FRENCH IRON-CLAD.

THE "Magenta," one of the most celebrated vessels in the French navy, is described as a line-of-battle ship—that is to say, she has nothing in common with those strange-looking machines, those "Monitors," &c., invented by the Americans. When seen from a distance in the midst of a squadron, she might in some measure be taken for an ordinary vessel, only lower in the water, but a nearer approach discloses some unknown features. Higher out of the water forward than aft, she presents the appearance of an enormous black mass, insensible to the action of the waves on which the other vessels near her gracefully move, no streaks indicating her rows of teeth, scarely any masts, very sharp both at stem and stern, terminating at each end like a wedge, and having at her bows an immense spur or ploughshare—those are the differences shown at the first glance, but when you go on her deck they become still more apparent. Her masts are those of a steam corvette, with only the rigging indispensably necessary to keep them standing. In combat everything is reduced to the lower masts. The boats, instead of being suspended to davits outside, are on deck, which is flush from stem to stern, and no guns are to be seen, with the exception of two bow-chasers. Nearly amidships, by the side of the funnel, is an iron-clad shot-proof kind of turret, which contains the means of communication with all the other parts of the vessel for the transmission of orders for working her, and for the fire of her guns. In action every one goes below, and this turret alone is occupied by the captain, another officer, some signal men, and a few sharpshooters. It is from this turret that all the orders are given. From the upper deck you descend into the gun decks, two in number, each having 24 rifled and breech-loading guns. Those pieces throw 60 lb. shot with an ordinary charge of 6 lb. of powder. All the armed part of the vessel, down to below the water-line, is iron-clad, but the casing does not extend quite to the stem or to the stern, as in the "Gloire" and "Normandie" frigates, the object of the change being to lighten the vessel. The parts not iron-clad are used—those aft for the cabins of the officers, and those forward for the quarters of the crew, the cooking, and the hospital—an innovation of material importance as regards the health of the sailors. In the iron-clad vessels first built everything was sacrificed to solidity, and the openings left for giving air and light were so few that those vessels were regular ovens. Every one remembers what the crew of the "Normandie" suffered when so placed under the burning sun of Mexico. The engine of the "Magenta" is similar to that of the "Napoleon," and is of about 2,700-horse power. Under full steam, she can make from 13 to 14 knots an hour. Her screw has six blades. The consumption of coal is 130 tons a day, and she can stow away from 700 to 800 tons. Moreover, her spur weighs 15 tons.

TO CORRESPONDENTS.

LUCIAN TWEED.—It means simply that he lodged his specification, which, of course, appeared in the list of Provisional Specifications. All the specifications are published, whether protection is or is not granted about six months after they are lodged. 2. Because it is not novel, or has been published or patented before, or is not likely to be of benefit, or because it is not patented by the real inventor or his legal assignee.

A.S. (Manchester).—We believe it is patented all over the Continent and in America.

RECEIVED.—H. R. E., S. T., C. C., J. H., J. C.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

STEAM BOILER EXPLOSIONS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I have read your report of the Astronomer Royal's Paper, read at the British Association, on Boiler Explosions, and, had it not been from inability, I should have been present, which would have saved any remarks from me here, as I should have given this explanation before the section. I have also been surprised at the articles on this subject in your contemporary, the *Engineer*. The explosive properties of water, when under a high temperature, are well known to most practical engineers; and if your pages were examined, it will be found that this subject has been explained so far back as 1827, and in other scientific publications, which have been published from time to time, if I remember right, by Mr. Gilman and others. The celebrated Mr. Parkins, the engineer, constructed a steam-engine to be worked by highly-heated water, when set free, and allowed to explode into a copper vessel, and then to the cylinder and piston through pipes connected with the collecting chamber. In 1851, Mr. W. Fairbairn delivered two lectures at Leeds on boiler explosions, which I attended. Mr. Fairbairn fully explained the explosive property of highly-heated water, and illustrated it by an experiment in the lecture-room. I have more than once explained the principle, before coroners' inquests and juries, when examined by them as to the cause of the boiler explosion they were inquiring into. One of my reports, of which I have now a copy before me, will explain all that need be said upon the subject.

REPORT.

"The shell or outer diameter of the boiler was torn and crumpled as though it had been paper: this, to many people, appears marvellous, who express their surprise that the steam contained on the upper side of a boiler, in what is termed the chamber and steam-room, should have such immense force; but it is not so much by the force of the steam proper as the highly explosive property of the water, when heated to a high degree of temperature and then instantly relieved from that temperature and pressure by the boiler giving way; hence follows the awful destruction, by the water exploding, as though it was ignited gunpowder."

I have known when the manhole lid has been removed suddenly from a boiler in which there has been steam pressure, and has emptied the boiler of water through the manhole. Not very long since, at Hull, the weight from a safety-valve lever was suddenly removed and the pressure released; the consequence was an explosion of the water. It has long been understood by even the fireman that the damage done by the explosion of a steam boiler was principally occasioned by the explosion of the water. Those who have noticed the steam let out of a boiler have also noticed it lowering the water from 2 in. to 6in. according to the pressure, thus proving the large quantity of water ready to escape in the form of steam when the resistance has been removed. I confess it has been amusing to read your contemporary on this subject, as though he had discovered something—placing himself the first, and the Astronomer Royal the second.

I remain, sir, yours respectfully,

J. HOPKINSON

Britannia Works, Huddersfield,
September 15, 1863.

[We have inserted Mr. Hopkinson's letter, though we are at a loss to understand its object. The simple assertion that hot water is explosive without stating why it is so, is worthless. If Mr. Hopkinson understands the solution of the problem, the fact of his suppressing it is anything but commendable, as by publishing it he would have conferred an important boon on the scientific world.—ED. M. M.]

SIR W. ARMSTRONG *v.* PATENTS.

SIR,—Sir W. Armstrong's remarks in his address to the British Association, with reference to inventors and patents, are characterized by the usual plausible superficiality displayed by him on that subject.

He said that the seeds of invention exist, as it were, in the earth, ready to germinate whenever suitable conditions arise, and no legislative interference is needed to ensure their growth in proper season.

Now, carrying out his metaphor, not to an extreme, but only to a fair and most legitimate extent, I would ask Sir William—Did the seeds of our wheat, barley, oats, turnips, and potatoes occur *naturally* in the earth; and did, or do, they spring up *spontaneously* to satisfy the wants of man, and of the animals dependent upon him? Or have these seeds been the subject of careful development, and always of careful cultivation, in order that they may produce what is wanted? And when a man grows a field of wheat, or of any thing else, is everybody to be allowed to help himself to the produce, without money and without price? Is the interference of Government in order to ensure to every man the fruits of his lawful labour—mental or physical—in place of being most expedient, absolutely just, and perfectly necessary, as hitherto universally regarded —to be viewed, at the bidding of Sir William, as an entire mistake? Most assuredly the man who would argue, as Sir William does, for the absurd results as are thus seen to be involved in his views, may be a very clever, or a very lucky mechanist; but that "a screw" must be loose in his own intellectual and moral mechanism, seems to be perfectly clear, and the sooner it is rectified the better. The patent laws are most creditable to our country, and most beneficial; and they will be made still more so by being improved; while their destruction would be an act of thorough barbarism, of the most disgraceful injustice, and of the vilest ingratitude; for what, it may be well asked, does society not owe to its discoverers and inventors? They pioneer the way, fight in the van, and are the great advancers of civilization. The patent laws, therefore, so far from being abolished, ought to be made still more effective by due modification, by proper scrutiny, and by their quick and cheap administration; while the ideas of Sir W. Armstrong on the subject —involving, as they do, ingratitude and robbery of, I hesitate not to say, the deepest dye—must be regarded as symptoms of as strange a hallucination as ever afflicted the human mind, leading as it does a man in the position of Sir William to become the open, the unabashed advocate of the grossest injustice, and of the most shameful illiberality! And I beg leave, therefore, to tell Sir William that the sooner he recants his present opinions, the better will it be for his own reputation, morally and intellectually. It will be observed that I have not alluded to any motive of a merely selfish sort as influencing Sir William to adopt his present course, believing that his conduct arises from most erroneous ideas of what would be best for the public interest. But he may always rest assured that the public interest will ever be best promoted, in the long run, by doing justice to all, and especially to those who discover and invent what is beneficial to mankind. He may rest assured that nothing great could be expected of a nation who could be guilty of injustice and ingratitude to its benefactors—as it would indicate a low, and degraded tone of moral and intellectual feeling, from which I trust, and have no hesitation in saying, the British public will ever be exempt; for a blacker day for Britain could not be conceived than when it should be otherwise.

Edinburgh, Sept. 13, 1863.

H. K.

Miscellanea.

During the recent meeting at Newcastle, opportunity was taken of an excursion of the British Association to the Marsden rocks by steamer, to exhibit the properties of Clifford's boat-lowering apparatus. The experiments were perfectly successful.

The *Phare de la Loire* states that two steamers are being constructed at Nantes, the object and destination of which are surrounded with mystery. The vessels are 80 metres long, are to have two engines of 400-horse power, will carry 22 guns, and their guaranteed speed is to be 14 knots an hour.

Speed would appear to be one of the main objects aimed at in their construction, as they are remarkably narrow, and their stems are said to be as sharp as the blade of a razor. A very suspicious circumstance in connection with them is that they are to be delivered up at sea, 20 leagues from Belle-Isle. It is generally believed, the *Phare de la Loire* says, that these vessels are intended for the Confederates.

We have received a pamphlet, just published, entitled, "A Southern Clergyman's Exposition of the Oath of Allegiance." We beg to inform the author and publisher of the pamphlet that the MECHANICS' MAGAZINE is a scientific and not a political journal. We have, like most men, our opinions and sympathies on the American revolution—the greatest revolution that ever shook a nation or a continent. We have, however, little or no sympathy with a class of men who are endeavouring to build up an iniquitous empire on the ruins of freedom, and still less sympathy with clergymen who blasphemously appeal to the sacred sanctions of Christianity in behalf of such a godless work.

The "Kirkham," 1,061 tons registry, with about 187 miles of the Indian telegraph cable on board, left Gravesend, on Friday, for the Persian Gulf, her precise destination being Bagdad. This is the second portion that has gone out, and the remaining lengths will be conveyed in three sailing vessels and a steamer. The entire length is upwards of 1,200 miles, and the weight about 5,000 tons.

A new blue has been produced, less costly than indigo, which may affect a large class of interests in India.

While we, as a Government, are about to make an experiment with the application of the double screw to a steam tug of 35 tons, the Federals in North America have, we are informed, resolved upon constructing four ships of 330 ft. in length, to which they intend to fix twin screws. We know that Lord Lyons and Sir Alexander Milne never lose an opportunity of forwarding useful information to the Foreign Office and to the Admiralty; but we should be more pleased if we were certain that their labour was not wasted. We are still dependent upon our old 95 cwt. or 8 in. gun, while the Americans are provided with—as we have often previously stated—15 in. guns of 20 tons weight, and capable of throwing shot of from 420 to 450 lb.; and while they will shortly be able to turn their longest ships almost upon their own axis, we still require a space nearly as large as Spithead, in which "to wind" our "Warriors," "Black Princes," &c.

The 24th company of Royal Engineers, at Aldershot, have lately been carrying on a series of siege works on the banks of the Basingstoke Canal. A number of models on a scale of one-sixth of elevated, sunken, and half-sunken batteries were constructed, and also trenches and communications. A number of model magazines were also made. A course of lectures on the subject of siege works, &c., delivered by Capt. W. A. Frankland and Mr. Hill, R.E., was well attended by the company. These operations are understood to be preparatory to the erection of siege works on a full scale, which it is intended to erect on the vacant ground between the North and South Camps. These latter works will be carried on very rapidly, orders having been issued for the men to work night and day, as in actual warfare. Large quantities of gabions, fascines, &c., have been made by the Engineers, and now stand ready for use.

We learn from the *Army and Navy Gazette*, that the Newhaven experiments were brought to a close on Friday evening last, after successive discharges from the 110-pounder, 70-pounder, and 40-pounder breech-loading Armstrongs. We regret to say that, under somewhat quicker firing of the last day, the defects of lead-coated shot and fine grooving were made only too apparent, the whole of the rifling of these guns leading on their becoming warm, and impairing the accuracy. As happened in the previous practice with the full charge of 12 lb., several of the shells burst at the muzzle, and one in the gun itself, cutting up the grooving, while others of the shells were stripped of their lead coating, and fell short. Last Thursday's experiment, which was conducted partly to try the fuzes, showed that the 110-pounder could not be depended upon in the hour of greatest need in a close hand-to-hand combat, and established also the fact that the peculiar nature of the Armstrong rifling rendered it very difficult, if not impossible, to obtain a safe fuze for the gun. Colonel Boxer's time-fuzes, with the "Moorsom" hammer, were not tried, owing to his not having perfected some of the minor details.

Though commanding a squadron composed of some of the most powerful ships in the Navy, Admiral Dacres, at a banquet given by the Glasgow Corporation, has expressed an opinion highly favourable to the use of war vessels of a much smaller class. He illustrates his remarks by a reference to the "Alabama," and stated that it was to such vessels as her that we must look for a clearance of the seas in actual warfare.

The *Siecle* publishes a despatch from Brest, stating that the "Florida" has been provisionally seized at that port, at the suit of a shipowner named Menier, of Brest, who claims an indemnity of £100,000f. for one of his vessels, seized by that cruiser.

A large massive cylinder, 6 ft. 5 in. bore, 16 ft. stroke, and weighing 40 tons, was cast at the Elswick Engine Works Foundry, on Wednesday week. The running of the metal occupied five minutes. It is for a steam hammer for the Russian Government. Several ladies and gentlemen were present during the operation. Captain Noble, Mr. H. M. Brunel and friends, and Mr. George Cruddas were amongst the spectators.

Last week a new locomotive for mineral traffic, constructed by Messrs. Dick, Stevenson, and Dick, for Robert Baird, Esq., Limerigg Colliery, passed along the street from their works to the Hallcraig Station of the Monkland Railways, propelled by its own machinery and attended by an admiring crowd. The only occasions where steam required the help of manual labour was in making sharp turns. A few turns taken along the rails put the efficiency of the machinery to a test which it bore satisfactorily.

The patent tanked ship "Jane," Captain Dawson, arrived in the Mersey on Saturday from Philadelphia, with a cargo of crude petroleum oil in bulk, belonging to the Liverpool and Romsey Oil Refining and Chemical Works Company (Limited). This is the first iron tanked vessel with petroleum that has arrived in Liverpool. The "Jane" was specially constructed for carrying oil from America to the company's works at Romsey, where it is discharged into hermetically sealed floating tanks, which are moored in the river, thus preventing the smell and waste from leakage so much complained of in Liverpool. The vessel, made the passage in twenty days.

On Monday one of the steam rams, concerning which so much has recently been said, was towed out of Messrs. Laird's dock at Birkenhead, and taken into the Morpeth Dock Basin, where it is understood the remainder of her fittings will be completed. It is expected that her trial trip will take place in a few days. It is but right, however, in the meantime, to state that her builders do not affect any mystery or secrecy with regard to what is going on in their works. On the contrary, they have invited Admiral Dacres and the officers of the Channel fleet to visit their building-yard, and inspect all that is going on there—a privilege which has been availed of to a considerable extent. A similar privilege as to inspection has also been conferred on the officers of the fleet by the Mersey Steel and Iron Works.

A course of experiments is now in progress in the Royal Arsenal at Woolwich which promises important results. A 32-pounder cast-iron service gun, strengthened on Capt. Palliser's plan, has been tested by firing a double-proof service charge, of 36 lb. of powder, and a cylinder gradually increased in size. The gun was fired upwards of 100 rounds without manifesting the slightest signs of giving way, and burst at the 107th round. The result is considered exceedingly favourable, and has been reported accordingly to the War Department. A number of cast-iron service guns have been consequently placed at Captain Palliser's disposal, to be bored and altered in accordance with his principle, and to be similarly tested at the Arsenal proof butt at Woolwich. Captain Palliser, it appears, has for many years, applied himself, to the study of cast-iron ordnance. His plan consists in removing a portion of the existing metal from the interior of the gun and inserting a combination of steel and irom tubes in such a manner as to relieve the outer cast-iron case from all strain, whereby the gun acquires all the advantages of the present wrought-iron ordnance. Capt. Palliser, it is understood, maintains the principle that steel and wrought-iron tubes of limited thickness can be so inserted into cast-iron skins or outer portions of the existing service guns as to relieve the structure from all strain, and that only a small portion of the gun is required to resist explosion, the remaining portion being useful merely to prevent recoil. Several guns are being prepared on Capt. Palliser's plan, and, should the issue of further experiments be such as to establish more fully the correctness of his theory, the cast-iron guns now in store in vast numbers may be utilised with economy and advantage.

We learn that a target-shield, for the embrasures of casemated batteries, is about to be constructed to test a plan submitted to the War Department by Mr. Chalmers, the inventor of the ship-armour target, which proved so successful last April. Mr. Chalmers was indebted to the generosity of Sir Morton Peto for his first target; but this, we believe, is ordered by Government.

We have authority for stating that the capital necessary for carrying out the Atlantic Telegraph enterprise in the best manner has now been provided. Tenders and specimens from eight contractors have been received in reply to the company's advertisement. These were all submitted to the scientific committee appointed by the directors, and consisting of Captain Galton, R.E., Professor Wheatstone, Professor Thomson, Mr. W. Fairbairn, and Mr. Joseph Whitworth. This committee have sent in their report, unanimously recommending the Board to accept the tender of Messrs. Glass, Elliot, and Co. The directors have accordingly accepted Messrs. Glass's tender, and entered into a contract with that firm, whereby the latter are bound to manufacture a cable of the best description, to be approved by the scientific committee and the Board. They also undertake to lay the cable across the Atlantic in 1864. The manufacture of the cable has already commenced.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 357, 372, 389.*
BOILERS AND FURNACES, 358.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 373, 378, 382, 396, 416.
SHIPS AND BOATS, including their fittings, 377, 401, 407.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 359, 381.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 419.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 354, 361, 366, 367, 371, 375, 380, 390, 392, 393, 398, 408, 410, 415.
BUILDINGS AND BUILDING MATERIALS, 363, 370, 374, 384, 413.
LIGHTING, HEATING, AND VENTILATING, 364, 368, 395, 399, 414.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 360, 379, 383, 386, 387, 394, 400, 403, 405, 409, 417, 418.
METALS, including apparatus for their manufacture, 353, 355, 365, 369, 385, 388.
CHEMISTRY AND PHOTOGRAPHY, 376.
ELECTRICAL APPARATUS—*none*.
WARFARE, 362, 406, 411.
LETTER-PRESS PRINTING—*none*.
MISCELLANEOUS, 352, 356, 391, 397, 402, 404, 412.

352. G. REDRUP. *Improvements in machinery for the cutting of shives, bungs, corks, spiles, and vent or other pegs, and also in machinery for manufacturing the knives or cutters employed therein, such machinery being also applicable to the manufacture of trenails and other cylindrical and conical articles.* Dated February 7, 1863.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

353. D. GROUCUTT. *An improvement or improvements in the manufacture of iron for making nails.* Dated February 7, 1863.

This invention consists in so manufacturing strip iron for the manufacture of nails as to avoid the waste caused by trimming, and to make the iron fibrous in the direction required for making nails. This the inventor effects in the following manner:—He takes a pile or faggot of good iron, and passes it through bolting or breaking down rolls, and immediately as it issues from these rolls he passes it without reheating through heavy suitably grooved rolls, driven at a high velocity, by which it is drawn out to a considerable length, perfectly parallel, very tough, and of much greater width than has hitherto been produced. In this state it is ready to be cut up into nails, and the fibre will be in the suitable direction for such purpose. *Patent abandoned.*

354. B. Dobson and E. Barlow. *Certain improvements in carding engines.* (A communication.) Dated February 9, 1863.

This invention consists in certain improvements upon the carding engines for which letters patent were granted to George Wellman on the 11th day of September, 1860, No. 2190. In the specification of the patent above referred to, the machinery described acts successively upon each alternate top card or flat to clean it, thus cleaning all the top cards or flats an equal number of times. Now the present invention consists in so modifying the machinery that the flats near the "licker-in," or the working and clearing rollers, when such are employed, are cleaned oftener than those near the doffer.

355. H. G. Williams and R. Price. *An improved machine for crushing and amalgamating auriferous quartz, and pulverizing and washing ores.* Dated February 9, 1863.

For the purpose of crushing the quartz, the inventors use an iron cylinder or barrel, mounted horizontally in bearings at each end, and inside this cylinder or barrel is or are placed one or more balls; the cylinder or barrel is then caused to revolve by suitable gearing. The inner surface of this cylinder or barrel is corrugated, or has alternate ridges cast on it, so that, upon its being set in motion, the ball or balls is or are carried a little distance round with the cylinder, until the centre of gravity of the ball or balls falls outside the projecting rib or ridge, when it of course immediately rolls over the temporary obstruction, and adds the effect of a blow to the simple weight of the ball, which greatly increases its crushing or pulverizing power upon whatever material may be placed in the cylinder to be acted upon. There is also mercury introduced into the cylinder with the quartz, by which the metal contained in the quartz is amalgamated with the mercury, at the same time that the crushing is taking place. *Patent abandoned.*

356. J. Macintosh. *Improvements in obtaining and applying motive power.* Dated February 9, 1863.

This invention consists in the rapid generation of power by the aid of oxygenous fuel, composed either of collodion, coke, coal, wood, nitrate of soda, or coke and nitrate of potash; in some cases sulphur may be used, or the chloride of potash, and, if desired, put into form with adhesive substances, such as mineral or vegetable pitch, resins, paraffin, gutta percha, caoutchouc, or glue. The prepared fuel is put into closed tubes or furnaces with valves for the escape of the gaseous products of the combustion, which may be used alone or in combination with steam, air, or other fluids in giving motion to the machinery. This oxygenous fuel may be put into ordinary steam boilers, which fuel, when ignited, instantly produces power to give motion to engines; or it may be used for other purposes where immediate power is required, or as an auxiliary. *Patent abandoned.*

357. D. Law and J. Downie. *Improvements in traction engines or common road locomotives.* Dated February 9, 1863.

This invention is not described apart from the drawings. *Patent completed.*

358. J. Goucher. *Improvements in regulating the admission of air into the furnaces of steam boilers.* Dated February 9, 1863.

This invention consists in regulating the admission of air into the furnaces of steam boilers by means of a spring or weighted piston, acted upon directly by steam from the boiler, and connected by a rod with a valve or damper in the furnace door. According to the pressure of steam in the boiler, so will the valve or damper be more or less closed. *Patent completed.*

359. H. and J. Smith. *Improvements in drills or machines for depositing seed and manure.* Dated February 9, 1863.

This invention has for its object to arrange and construct the several parts of the machine in such a manner that the tins or funnels for conveying the seed or manure down to the coulters may hang straight down, and be less liable to become damaged or put out of order than heretofore. *Patent abandoned.*

360. W. B. Rooff. *An improved respirator.* Dated February 9, 1863.

This invention consists of a respirator, partly an improvement upon that patented by the present inventor, dated the 21st day of September, 1848, No. 12,273. The inlet tubes or passages are made to communicate with a chamber or receptacle, into which can be placed at pleasure air-purifying materials, or a piece of sponge, or other suitable material for holding medicinal preparations which impregnate the atmosphere before entering the lungs. A system of valves is used similar in action to those described in the patent dated as above, by which the exhaled air is not allowed to pass through the chamber containing the medicinal or purifying agents, but gives up its heat to the metal tubes, which heat warms the inspired air before it reaches the purifying or impregnating chamber on its way to the lungs. *Patent abandoned.*

361. J. Crosby and J. B. Smith. *Improvements in carding engines for carding and drawing flax tow, in part applicable to carding cotton and other fibrous substances.* Dated February 10, 1863.

This invention is not described apart from the drawings. *Patent completed.*

362. T. Hill. *Improvements in the arrangements employed for the protection of markers at rifle butts.* Dated February 10, 1863.

This invention has for its object the better protection of the markers when engaged at rifle butts or targets, in combination with the means employed of indicating the score, and position of the shot-mark upon the target, whilst the marker is in the act of wiping out the same, for which latter purpose letters patent were granted to the present patentee, dated July 12, 1862 (No. 2007), in connection with pits of improved construction sunk in front of the target for the protection of the marker. The present improvements are applicable to rifle-butts or targets where mantlets or shields are employed for the protection of the markers, the mantlet or shield being placed close to the target, and so arranged and constructed that the marker can readily see where the target is struck, and then by means of the brush and signal combined wipe out the shot-mark, and at the same time indicate its position to those at a distance without exposing himself to danger. For this purpose a mantlet is erected on one side of the target of any suitable shot-proof materials, the side or edge nearest the target being formed with a wing or wings placed at an angle inwards towards the marker, and having a small window protected with strong plate glass, and, if necessary, covered with wire gauze or other suitable material, through which the marker can readily see the face of the target. Near to the edge of the target a splash-board is placed, and between the wing of the mantlet and this board a narrow space is left so that the marker whilst looking through the window or opening for the sight can pass the combined brush and signal through the space, and thus readily wipe out the shot-mark, and at the same time indicate its position upon the target in the manner described in the specification of the former patent before referred to, but in which arrangement the marker is protected by a pit that is sunk in front of the target. *Patent completed.*

363. R. Burley. *Improvements in handles for hammers, mallets, picks, mattocks, and similar tools.* Dated February 10, 1863.

This invention consists, according to one modification, in making the handle of two or more longitudinal pieces of wood, of the same or of different kinds, glued or otherwise cemented together. *Patent completed.*

364. M. Wigzell. *Improvements in machinery or apparatus and method to be used in the manufacture of every description of candles, tapers, and other lights.* Dated February 10, 1863.

By the machinery or apparatus employed by the patentee he makes the candles, tapers, or other similar lights complete, that is to say, so that they will pass out of the machine with wick points, and of any required length, diameter, or shape, and at any speed that the machinery grease or other material or materials can be worked; and he places the wicks in the candles whilst the candles are being made, as well as by the other methods herein stated; and by the said machinery he makes the candles and other lights principally by pressure, that is to say, he forces the grease or other material when either cold, hot, or in a semi-cold or hot state, through tubes or apertures, so as to form them into any required shape or size, with or without wicks, and when they are thus formed, he cuts them into any required length, and points them by a pointing apparatus that is attached to the machine. Or he shapes the ends by forcing the grease into moveable pointing dies attached to the machine; or he points the candles in a separate revolving, cutting, or pointing apparatus after they have been made with the wicks in them. *Patent completed.*

365. M. Cartwright. *Improvements in combining plastic substances with metals.* Dated February 10, 1863.

This invention consists in combining by grinding together a solution of vulcanized india rubber, or plain india rubber or gutta percha, and metal leaf or metal in a state of finely divided powder. Instead of a solution of india rubber or gutta percha, the patentee sometimes uses kampticon, parkesine, dissolved amber, gum copal, or other suitable vehicle, or two or more of these substances combined. After grinding the materials together, he sometimes subjects them to heat for the purpose of hardening, and in some cases of "curing" them. *Patent completed.*

366. J. F. Bottom. *Improvements in means or apparatus for dressing lace and other fabrics.* Dated February 10, 1863.

This invention consists in substituting for the ordinary frame endless bands, straps, or chains with pins as the means of holding the fabric to be dresed by giving sideway tension to it. Such bands, straps, or chains are supported and guided in moving along the opposite sides of the apparatus, whilst at the ends of the apparatus they pass over suitable guide pulleys or rollers, so that having passed over the pulleys or rollers of one end, they pass underneath to the opposite end, and they may be of lengths adapted to the longest length of fabric required to be treated; and the fabric in place of moving to and fro will be constantly moving in one direction. *Patent completed.*

367. W. Whitaker. *Improvements in apparatus and processes for steeping, boiling, washing, bleaching and dyeing fibrous materials or slivers, stubbings, rovings, yarns, or woven fabrics of the same.* Dated February 10, 1863.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

368. A. Corneau. *An improved hot-air stove.* Dated February 11, 1863.

This stove is made for the purpose of burning pit coal, but it can also be fed with coke. The fire is kindled at the top, and descends as the burning progresses. From this new arrangement it results that the carburetted gases are completely burnt as they flow through the layer of burning coal which produces an evident saving of coal, because the inflammable gases are burning and producing heat whilst in other similar apparatus they are utterly lost. *Patent completed.*

369. H. Donald. *Improvements in machinery for shearing, punching, and rivetting metals.* Dated February 11, 1863.

This invention consists, according to one modification or system of arrangement, of an ordinary punching and shearing machine combined with a machine for cutting or shearing angle iron, and for punching or rivetting metal plates, the machines being so arranged that they may be worked either jointly or separately as required. On the sole plate of the ordinary punching and shearing machine is arranged the vertical framing of the machine, and the steam engine which gives motion to the moving parts. On the overhead crank shaft,—which is driven from the engine—is fitted a pinion, which gives motion to an intermediate wheel on a horizontal shaft arranged parallel to the crank shaft. On this second shaft is a pinion which drives a spur wheel, fitted on a shaft which extends across the centre of the machine, and operates the main lever of the angle iron machine. This machine is carried upon a suitable sole plate arranged at right angles to the punching and shearing machine. Extending up from the sole plate are two strong standards, which support the main lever carrying the shears; these standards extend each way in a lateral direction, and are recessed on each side to receive the lower cutters or blades of the shears. Below these recesses openings are formed in which horizontal punches traverse to and fro. The main lever has cast on it a short transverse shaft, which is carried on bearings arranged in the standards; its outer end extends over the contiguous shear cutter, and a corresponding cutter is fitted to the lever over the inner recess. These shear blades or cutters are of an angular form at the lower edges, so that they do not come down flat on the plate to be cut, but divide it from the outer edge first, and gradually advance, similar to the action of a pair of scissors. The inner end of the lever extends towards the contiguous punching machine, and is connected to a strap encircling an eccentric which moves to and fro upon a feather formed on the main driving shaft of the punching machine. The eccentric is made with a segmental opening in it, so that when moved slightly along the shaft by means of a hand lever, a crank pin fixed in the face of the contiguous spur wheel takes into the segmental opening, and communicates motion to the lever. Below the bearing portion of the lever there is a prolongation in which is fitted the pads that act on the rams of the punches, and cause them to operate alternately. *Patent completed.*

370. E. T. Hughes. *Improvements in apparatus for drilling wood, stone, iron, or other materials.* (A communication.) Dated February 11, 1863.

This invention relates particularly to the instrument known as a brace, used by joiners and other mechanics; and the improvements consist in attaching to the brace a spring, by means of a small screw; the said spring is slightly hollowed at one of its ends to receive a pin having a hollowed part to allow the passage of the bit or drill, which pin by means of the spring is forced through the socket of the brace, so that it may enter the groove cut in the head of the bit or drill, in order to secure the said bit or drill in the socket, and prevent its falling out. This is a great advantage, as well as a saving of time, and when the bits or drills have to be removed or replaced the hollow part of the pin is made to correspond with the hole in the socket. The sockets can be made of various forms, and either bored or slotted internally to gauges so that any kind of bit or drill corresponding with its intending socket may enter it easily. *Patent completed.*

371. J. Duckworth. *Improvements in the manufacture of paper.* Dated February 11, 1863.

This invention consists in mixing with the fibrous pulp commonly used in paper-making a suitable proportion of a grey or slate-coloured material found principally in the coal mines of Lancashire and other parts of Great Britain generally covering the seams of coal. The said mineral is principally composed of alumina, common clay, and shale, and is ground or pulped in any suitable manner. By this admixture the paper is made cheaper, of finer quality, and more susceptible of glaze than by the ordinary modes employed, and also forms various shades of colour without the aid of other colouring matters. *Patent completed.*

372. D. Radcliffe. *Improvements in valve taps.* Dated February 11, 1863.

This invention relates to that class of taps which have the valves closing with the stream or current of the water or other fluid they are intended to control; and although taps constructed according to this invention are specially suitable as ball taps, and lever-handle taps, they may be variously used or employed. The body of the tap—which may be of any desired form—has a seating therein for an ordinary or other valve, the spindle of which is carried through or elongated from both sides of the same. To the end of the spindle at the back of the valve there is secured by screw nuts or otherwise a diaphragm made of a sheet of india rubber or other flexible material, the circumference or edges of which is or are tightly secured between flanges or otherwire, and over this diaphragm there is a blank cap—that is, a cap without openings of any kind therein. Between the valve and the diaphragm the supply connection is made, so that, when the tap is closed, the fluid presses both on the back of the valve and on the diaphragm. That part of the spindle on the other side of the valve is in the nozzle or outflow passage, and it is to this part that a ball lever, weighted lever, or other arrangement to operate the valve is connected, thus rendering it necessary when the tap is being opened that the spindle and the valve should be moved in a direction against the flow of the fluid supply, and the diaphragm forced against the blank cap herein before mentioned. The connections of the operating lever may be made in any convenient manner, either to the end of the spindle outside the nozzle or discharge way, or to the said spindle through the sides of the said nozzle or discharge way. *Patent abandoned.*

373. C. P. Carter. *Improvements in road-making.* Dated February 11, 1863.

The inventor casts, moulds, or forms iron or similar hard metal into blocks or pieces of various shapes and sizes, and then places them together so as to form a road, consolidating the same with stone, concrete, or other material into a compact surface, having, however, good foothold for horses and other cattle. *Patent abandoned.*

374. R. Saunders. *Improvements in pavements and floors, which improvements are also applicable to stairs and steps.* Dated February 11, 1863.

This invention consists in using double angle iron, or iron or other hard metal, bent, rolled, or otherwise prepared, so as to form a trough or receptacle, which receptacle the patentee fills with wood or other material, he

prefers to make the surface of the wood to overlap the top edges of the metal; or he can use the wood thus shaped without the trough or receptacle. He causes each of the troughs or receptacles, fitted as aforesaid, to have spaces between them when laid down, in order to facilitate surface drainage: or he places wood blocks or timbers together, connecting them by iron or metal connections, so as to form a mass or masses of pavement of equable surface. He sometimes places sleepers beneath the said troughs or receptacles filled as aforesaid. Or he uses brick-work, stone-work, or cement in substitution for the sleepers. *Patent completed.*

375. W. SYMINGTON. *Improvements in weaving and in apparatus therefor.* Dated February 11, 1863.

The patentee claims using a single leaf of heddles or healds in combination with jacquard harness, or other equivalent means, in the weaving of muslin or leno curtains, or similar fabrics. *Patent completed.*

376. R. A. BROOMAN. *Improvements in photographic apparatus.* (A communication.) Dated February 11, 1863.

This apparatus enables the manipulator to operate in full light upon damp collodion, to sensitize the glass, and to finish the proof in the light. The apparatus does not alter the negative now used, but it serves as an auxiliary to it. In the apparatus the following characteristic elements are combined:—The employment of two vertical and independent bath vessels, arranged to allow of the glasses being easily plunged therein; one vessel, containing the bath of silver for sensitizing the damp collodion, may be of gutta percha, hardened rubber, or other material having no action on the bath; the other, containing the iron bath for developing the picture, should be of yellow or orange-coloured glass; if made of any other material, it should be lined with yellow coloured glass. There is a frame for holding the glasses to be exposed, capable of being opened and closed at bottom by withdrawing or inserting a sliding bar. There is a second frame for holding the collodionized glass in the former frame, which second frame is styled the plunging-frame, because it is used for introducing the glass into the bath vessels, entering also with it; it is insulated from the first frame, and may be passed through it; a piece of catgut is attached to the plunging frame to raise and lower it into and out of the baths. *Patent completed.*

377. E. HUMPHRYS. *Improvements in apparatus for steering ships.* Dated February 11, 1863.

For the purposes of this invention, the inventor employs hydraulic power, there being a cylinder and piston connected with the tiller, and giving motion thereto, the cylinder being supplied with water or liquid under pressure from an accumulator or chamber, in which it is kept at a constant pressure, and into which the liquid is pumped by the engines of the ship; so far the arrangement does not differ from what has before been practised. According to this invention, however, on the bridge of the vessel or other place from which it is desired to steer the ship, and at a distance from the steering cylinder, the inventor places a slide valve contained in a chamber, and this is connected with pipes which are led away to each end of the distant cylinder. The valve chamber also communicates with the accumulator. The valve is connected to the steering lever, and is moved by it, so that, when the steering lever is moved towards either side, it allows the water or fluid to flow from the accumulator to the steering cylinder, so as to produce a corresponding motion of the rudder. When the valve allows the water or liquid to flow to the cylinder on one side of the piston, it allows it to escape from the cylinder on the other side of the piston, but when the steering handle and valve are placed centrally, the liquid is locked in the cylinder, and the rudder is held stationary wherever it may have been placed. The two pipes are laid from the valve chamber to the steering cylinder in a groove in one of the deck planks, and the groove is covered with metal plate, so that the pipes may be out of the way of injury, and yet readily accessible; and in the same grooved plank a rod is placed which moves with the rudder and actuates an indicator placed near the steersman. *Patent abandoned.*

378. H. WYCHERLEY. *Certain improvements in the construction of, and mode of applying, wings or dirt screens over the wheels of carriages.* Dated February 11, 1863.

The patentee claims the "distinct" use of auxiliary springs secured to the axle for supporting the wings or guards of carriages, in contradistinction to their being supported or connected with the bodies of such carriages. *Patent completed.*

379. F. OPPENHEIM. *Making a plastic compound for dental purposes, to be used instead of wax, gutta percha, or gums, in taking the impression of the mouth.* Dated February 12, 1863.

This invention consists in taking white French chalk, china clay, or any other mineral, provided it be not injurious to the mouth, reducing it to an impalpable powder, adding a little colouring matter, and mixing it thoroughly with oil until brought to the consistence of putty or dough, and employing it in the way well known to dentists for taking the impression of the mouth, instead of the wax, gutta percha, gums, or other substances used hitherto. *Patent abandoned.*

380. E. KEMP, J. NEEDHAM, and O. ROBINSON. *Certain improvements in self-acting mules for spinning.* Dated February 12, 1863.

This invention is designed to dispense with, and supersede the use of, the sector, as hitherto employed in mules to actuate the fallers, and consists in a novel arrangement and combination of apparatus. Upon the inclined surface of the copping rail a small bowl runs, which is attached by means of a stud or bracket to one end of a lever, having its fulcrum on the framing of the spindle carriage, the opposite end also being furnished with an adjustable bowl which comes beneath and presses against a projection attached to a vertical lever connected with the faller shaft, such pressure being caused by the action of the first bowl on the inclined surface of the copping rail as the mule carriage runs in. Whilst the fallers are guiding the yarn and shaping the cop, the adjustable bowl is retained under the said projection, thereby affording steadiness and certainty of action to the fallers, the release of such bowl being effected by means of a horizontal bar sliding in bearings on the top of the spindle carriage, such bar being in a line with the lower end of the vertical lever, and so arranged that, when the carriage runs in, it shall displace the vertical lever, and thereby allow the fallers to rise, placing them again in position for action. *Patent abandoned.*

381. A. MORTON. *Improvements in lawn-mowing machines.* Dated February 12, 1863.

This invention relates to improvements in lawn-mowing machines, and consists—1, in the arrangement of the driving gear. For this purpose the inventor fixes on, or casts in a piece with the side frame of machines, an internal toothed circle, which works a small pinion mounted on the crank pin of a crank mounted on and revolving with the main axle of the machine, which crank pinion is thrown out or into gear by a sliding clutch in the usual way. This crank and pinion again take into a second pinion mounted loose on the main axle outside the framing; of a piece with or fixed to this pinion is a larger spur wheel which takes into an intermediate stud wheel, transmitting the motion to a pinion fixed on the axis of the revolving cutters. By this arrangement of the gearing, a high speed is obtained in the cutter with a simple and compact arrangement of the gearing. The second part of the invention consists in the use of india rubber, gutta percha, leather, or any other suitable substance or composition as a material for the formation of the toothed gearing or surface communicating the motion which it transmits without noise. *Patent abandoned.*

382. W. CLARK. *Improvements in the bearing surfaces of shafts and other axles.* (A communication.) Dated February 12, 1863.

This invention relates to the application of hard metal spheres for transmitting the load weight of journals and shafts. These spheres are contained in a suitable box, and the journal, in its rotating, produces a rolling movement in the whole of the spheres, thus creating a rolling friction in lieu of the ordinary sliding or rubbing friction of journals and shafts in their bearings. *Patent abandoned.*

383. S. H. PHILLIPS. *An improved fastening for purses, portmonnaies, pocket-books, bags, reticules, and such like purposes.* Dated February 12, 1863.

The inventor proposes to take a flattened tube of thin sheet iron or other metal, in which he places a slip of brass or other metal forming a slide, and having cut therein a slot through which a pin projects being inserted and fixed through the sides of the tube; the slide projects beyond one end of the tube, and extends somewhat below the middle portion thereof, and then compresses a small spiral spring fixed near the opposite end of the tube, the spring maintaining the position of the slide against the pin which prevents the slide being pressed out of the tube. The central portion of the tube is pierced with an aperture, half of which is closed by the slide, and the remaining half exposed by reason of a rectangular space cut in the slide. This portion of the fastening is to be fixed within the front lining of the bag, purse, portmonnaie, or other article, and a lock plate should be fixed outside a suitable aperture therein, being arranged to expose the aperture in the tube within. To the flap of the purse, bag, or portmonnaie a projecting stud or pin is fixed, having a notch cut therein on one side, and its extremity presenting an angular or wedge-shaped surface. It will be obvious, when the stud is pressed into the lock-plate by the closing of the flap, that it will enter the orifice in the tube, and, coming in contact with the side of the aperture in the slide, will force it towards the spring, the slide then running back into the notch and fastening the bag or purse. *Patent abandoned.*

384. S. LAMB and J. SPINK. *Improvements in machinery for tenoning, grooving, sawing, and otherwise cutting wood.* Dated February 12, 1863.

The following are among the prominent features of this invention:—In constructing a tenoning groove and sawing machine, the inventors employ two parallel axes, so arranged that the distance between them can be adjusted, each axis for this purpose being mounted on a slide on the main frame. The slides are capable of being traversed by screws, each slide having two screws, one near each of its ends, and these screws are turned simultaneously by means of bevelled gear from an axis at right angles to them. These parallel axes carry the tenoning cutters; the cutters for cutting the flat of the tenon are of ordinary construction; but to cut the shoulder of the tenon, in place of employing straight cutters sharp at the end, as is usual, the inventors employ discs of steel sharpened all round; these are each connected with the cutter head by a central screw, so that, when by use one portion of the cutting edge of the disc has become dull, another portion can be brought up by turning the disc partly round, and this without in any way interfering with the adjustment of the machine. In order that tenons may be cut in which the shoulder on one side of the piece of wood is further from the end thereof than the shoulder on the other, they make one of the cutter heads to slide longitudinally on its axis. In order to obtain this adjustment, they prefer to employ a screw passing through the head, and entering a hole tapped in the end of the axis, and they clamp the head in its proper position when it has been adjusted. According to this invention, they mount the cutter axis in conical bearings, there being two cones on each axis to run in the bearings, and one of these cones is adjustable, so that it can be set up to compensate for wear. The table for presenting wood to the tenoning cutters is capable of being moved to and fro on guides fixed at right angles to the cutter axes. *Patent abandoned.*

385. G. H. BIRKBECK. *Improvements in processes or means employed for separating or extracting silver or other metals from lead.* (A communication.) Dated February 13, 1863.

This invention refers to a former patent dated October 23, 1861, No. 2643. The employment of a bath of sulphuric acid, the inventor states, is preferable to that of muriatic acid, because of the formation of chloride of silver, which is difficult to decompose by heat without loss. The bath of sulphuric acid, on the other hand, gives place to water charged with sulphate of zinc, and gives it up at a profit on the cost of the process in case of any demand in the locality for this sulphate. In the absence of such demand, it can be converted into oxide of zinc, if it is more marketable. The second part of these improvements relates to the economy of zinc employed, and consists in restoring to the desilvering boiler, for the subsequent operations, a certain quantity of zinc bearing lead; that is to say, lead susceptible, on account of its small proportion of silver and its great proportion of zinc, to take up a part of the silver or lead of the said boiler. *Patent completed.*

386. S. M. INNES. *Improvements in the construction of pianofortes.* Dated February 13, 1863.

This invention consists in constructing pianofortes so that by their mechanism they will enable performers to play any piece of music written in any key of sharps or flats, as if it were written in any lesser number of sharps or flats, or even in the key of C, the actual key not being changed, but by the employment of stops a change takes place, and all or as many as are required of the notes of the black keys are produced by the white ones or natural keys, and the accidentals (if any) in keys from one to five flats and one to five sharps, can be produced by striking the half note below for flats, and above for sharps, the naturals being played in flat keys as a flat, in sharp keys as a sharp, accidental sharps and flats as usual. For keys of seven flats and seven sharps, the key-board is moved up half a tone for sharps, and down half a tone for flats, the accidental naturals being played on the half note above in flats, and the half note below in sharps. For keys of six flats and six sharps, the key-board is moved as for seven flats and seven sharps, and the seventh flat is made natural by pulling out a sharp stop, and the seventh sharp likewise by pulling out a flat stop. Also a moveable key-board is used, which can be shifted at pleasure (to use with or without the aforesaid) raising or lowering, as desired, the pitch of the music to be played, to suit the pitch of instruments and voices. *Patent completed.*

387. W. E. GEDGE. *Improved table apparatus for promoting the comfort of persons at sea.* (A communication.) Dated February 13, 1863.

This apparatus, which may be of any shape, and as ornamental as may be desired, is constructed as follows:—On two upright supports fixed to the table, and sufficiently above it to avoid touching it in the come-and-go motion, is a moveable axle to which is suspended a stand or tray, on which are placed the bottles, glasses, or other objects, and a weight in the shape of a moveable cylinder is carried at the lower end of vertical pieces for the purpose of always preserving the equilibrium of the entire apparatus when tossed about by the rolling of the ship. The axle of the apparatus must be placed parallel with the sides of the ship; nevertheless, when the inconveniences of pitching are to be avoided, the axle may be placed slightly slanting athwart-ship. The principle of this arrangement is, therefore, suspension rendered applicable—firstly, by the reduction of the radius of the segment described as much as possible, so as at the same time to reduce the come-and-go motion almost to nothing; secondly, by the position of the balance weight, the axle of which is parallel to the axle carrying the stand or tray, and is placed well in the centre of the lower extremities of the perpendicular pieces carrying it. The duty of this weight is not only to prevent the apparatus swinging about, but also to prevent it from capsizing; its weight must therefore be in proportion to that which the épergne or stand will have to carry. *Patent abandoned.*

388. J. JONES. *Improvements in the manufacture of lead, tin, and other metals, or amalgamation of metals of a like fusible nature, into sheets of any required thickness and length, and also coating one or both sides of pipes and sheets of lead and other metal, or amalgamation of metals, with tin or other substances, and in the apparatus connected therewith.* Dated February 13, 1863.

The patentee claims—1, The use of a vessel for containing the molten metal to be formed into sheets, which is closed at the top, and causing it to move on the piston or ram by hydraulic power, in place of moving the piston as heretofore, so as to allow the sheets or tubes of metal or amalgamation of metals to be formed by pressing the metal through dies in the side or sides of the vessel containing the molten metal, or through dies placed on the head of the fixed piston and passages formed there through, to allow the sheets to be delivered from one or both sides of the piston below the container, substantially and in the manner and for the objects described and set forth. 2, The use of a fixed or moveable piston fitted with forming knives or dies, and constructed with vertical passages and lateral ports for the formation of sheets of lead or other metal, or amalgamation of metals, as described and set forth, or any mere modification of the same. 3, The use of a fixed ram, in combination with moveable container having the dies or forming knives placed in the bottom or side or sides of the container, in place of at the top, as heretofore, substantially in the manner and for the purposes described and set forth. 4, Forcing out the molten metal or amalgamation of metals to be converted into sheets from the container, through suitable dies at or near the bottom thereof in a cylindrical or tubular form, and then receiving it on suitable mandrils, or otherwise cutting it open by fixed or moveable knives, saws, or other mechanical equivalent, and flattening it out into sheets by rollers, or in any other convenient way. 5, The peculiar mode and apparatus for tinning or otherwise coating as formed sheets of lead or other metal, or amalgamation of metals, as described and set forth, or any mere modification of the same. And, lastly, the general construction, arrangement, and combination of the various parts of the apparatus. *Patent completed.*

389. J. F. SPENCER. *Improvements in steam engines* Dated February 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

390. J. ROBERTSON. *Improvements in apparatus or means for printing woven fabrics by blocks.* Dated February 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

391. J. GRANTHAM. *Improvements in hydraulic presses.* Dated February 13, 1863.

The object of this invention is to vary the amount of power given out by a single ram in a hydraulic press, although the pressure of water or other liquid may be uniform. The first part of the invention relates to an arrangement by which the power exerted by the ram is increased at a certain distance or distances during the stroke, resulting in an economical process for packing or pressing any material into a smaller bulk, and which requires less pressure at the commencement than at the conclusion of the stroke, and especially useful where an accumulator is employed. In order to effect this object, the patentee constructs both the ram and cylinder in which it works of two or more diameters, each of which is provided with a packing of the ordinary kind. The ram has a telescopic shape, but does not slide within itself; its smallest diameter is first operated on by the water pressure, by which it is forced to a certain distance, when the next diameter is also operated upon, giving an increased force and, so on to the next, according to the number of gradations in the ram, the power being increased proportionately to the increased diameter of the ram. The spaces between those portions of the ram and cylinder formed during the traverse, but not yet supplied with the high pressure, are filled up by means of a flow of water at a low pressure from a pipe fitted with a self-acting valve, which closes immediately the high pressure is turned on, and prevents the water from receding. For the purpose of turning on the water from the accumulator or pumps to the increased diameter or diameters of the ram at the proper time and distance of traverse, the patentee arranges a pipe communicating either direct with the small end of the cylinder, or with a supply pipe, and fits the same with a stop valve and lever. This lever may be actuated in any convenient manner by the traverse of the ram, so as to set on the valve as required. Another convenient method for turning on the high pressure of water is by forming holes or longitudinal or diagonal slots for a certain distance on the side of the ram, so that, when it has traversed such distance, the water pressure may be communicated past the packing from the smaller diameter of cylinder to the next of larger size. The second part of the invention relates to an arrangement in which the power exerted by the ram is greater at the commencement of the stroke than at the conclusion. For this purpose he constructs the ram of a telescopic form, consisting of one ram sliding within another of larger diameter but of less length, the external ram sliding within a cylinder provided with a shoulder or stop; when the pressure from the accumulator or force-pump is applied, it operates upon and actuates both the rams, which traverse together a certain desired distance, until they arrive at a projection or stop, when the pressure actuates only the internal ram, which being of smaller diameter exerts a diminished force and requires less water. *Patent completed.*

392. W. ROBERTSON. *Improvements in machines for spinning and doubling.* Dated February 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

393. G. WRIGLEY and S. MORRIS. *Improvements in machines for spinning and doubling.* Dated February 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

394. O. H. HODGE. *Improvements in hat-brims, and in the apparatus or machinery used in such manufacture.* Dated February 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

395. J. A. SCHLUMBERGER. *Improvements in heating coal tar dead oils, and for producing phenic or carbolic acid.* (A communication). Dated February 13, 1863.

The object of this invention is to effect an economy in the manufacture of phenic or carbolic acid from dead oils, or thick heavy oils obtained from coal tar. To this end it is proposed to substitute lime for the potash or caustic soda which has been generally used for separating the said phenic acid from dead oils. *Patent completed.*

396. S. WHITAKER. *Improvements in indicating the positions or conditions of railway signals and points, and in the apparatus employed therein.* Dated February 13, 1863.

This invention relates to indicating the positions or conditions of railway signals and points. As applied to a lamp or night signal with a view to indicating to the signal man at a distance whether the lamp continues to burn or not, it is proposed to place inside the lamp, in any position which will insure its being heated by the same when burning, a piece of metal of any desired or convenient form, which will readily expand by the heat imparted to it. The expansion or contraction of this piece of metal is made to establish an electric contact, and complete a circuit from a battery through a galvanometer. For example, so long as the piece of metal is expanded by the heat, the current passes through the galvanometer, and the consequent deflection of the needle indicates that the lamp is burning; but should the light become extinguished, the cooling of the piece of metal and its contraction will break contact, and the circuit being interrupted the needle will return to its original position, again indicating to the signal man that the light is no longer burning. According to another part of this invention, it is proposed to connect railway points and crossings with a battery, and with suitable contact surfaces, so that, when the point is open or closed, as the case may be, a circuit will be established through a galvanometer, the needle of which will indicate the position of the points in connection therewith. The same arrangements for indicating the positions of the points are equally applicable for indicating the position of the day signals. By providing an ordinary signal with proper contact points, and connecting such points by wires with a battery and galvanometer at an adjoining station or intermediate point, the setting of the first signal is instantly indicated by the needle to the signal man of the second signal. *Patent completed.*

397. G. HASELTINE. *Improvements in lever horse-power machines, the cog-gearing employed being applicable to other machines.* (A communication.) Dated February 14, 1863.

The nature of this invention consists in a novel construction of the master wheel, and its arrangement in connection with the intermediate gear wheels; in rotating the main shaft with only the stepping for its bearing; in supporting the driver's seat on a standard that may be attached to or detached from the main shaft at the pleasure of the driver; in so constructing the machine that the dust and other foreign substances are excluded without the use of a casing; and in connecting the band wheel shaft with the tumbling shaft in such a manner that both rotate in one direction at unequal rates of speed. *Patent abandoned.*

398. R. BAGALEY. *Improvements in the construction of creels for warping machines, and other machines to which creels are applied.* Dated February 14, 1863.

The nature of this invention consists in making the bushes of creels of box or other hard wood, with a slot in which the spindle or bobbin peg revolves, and with a back to prevent the spindle or bobbin peg from moving endwise. These bushes are let into and secured to the uprights of the creel in the same manner as the glass bushes heretofore employed. *Patent abandoned.*

399. J. C. JEFFCOTT. *Improvements in the production and generation of gases.* Dated February 14, 1863.

The object sought to be obtained by this invention in the production of gas for lighting and heating purposes is, chiefly, the utilization of the heat now not used in steam or other furnaces, and open or closed fireplaces of every description. The means for effecting this object consist in introducing into the furnaces or fireplaces vessels of various forms, composed of cast iron, clay, or other metallic substances, and placed according to the construction of the said furnaces or fireplaces, and made to correspond with the furnaces or fireplaces now in use, or to be used hereafter, for these or other purposes, so as that the said heat may be used. The vessels to be generally used will consist of a retort or retorts, to be placed lengthways or otherwise over or at the sides, or as may best suit the fire bars of the different fireplaces, and in these retorts will be placed the various substances, animal, vegetable, or mineral, from which the different gases are to be obtained by distillation for lighting and heating purposes, and by the heat before referred to and not now used for these purposes. The gases, after being set free, are conducted by pipes to the condenser, which consists of two cylinders, one placed in the other, the outer one holding water; the gas, on entering, goes to the inner cylinder, which it fills, and is then driven by the hydraulic power to the gas holder, in its tank filled with water saturated with lime, and holding the salts of soda in solution, through which it passes, and by this means is perfectly purified and ready to be used. *Patent completed.*

400. W. C. PAUL and A. T. SHORE. *Improvements in the mode of constructing spring mattresses and other such articles for sitting and reclining upon.* Dated February 14, 1863.

For the purposes of this invention, in constructing a mattress or like article of furniture, two separate frames made of wood, metal, or other suitable material, of proper strength, are used and placed one over the other. On the bottom of one of these frames is placed a series of laths, made of deal or other suitable material, reaching from side to side of the frame, and placed at regular distances from each other, for the purpose of fastening and supporting the spiral springs used in making spring mattresses, and which are fastened to the laths by strong wire staples. The spiral springs to be used may be of three different sizes, the largest at the head, the medium in the middle, and the smallest at the foot of the mattress; the springs are arranged in these positions for the better and more easily sustaining the weight of the occupants. The upper frame is to be of the same size and shape as the bottom one, and placed over the bottom one, leaving about 7 in. space at the head, and about 5 in. at the foot. The tops of the spiral springs are all securely fastened to the upper frame by strong and suitable cords drawn from side to side of the frame, and tied on two sides of each spring over which it passes. The same is also done from head to foot, and may be also diagonally from corner to corner, the whole, when tied in this way, forming eight distinct and separate knots on each spring, and thereby firmly fastening all the springs in their proper positions to the upper frame. To keep this frame from turning over on either side, strong webbing is fixed on the corners of the top frame, and drawn down in the middle and fastened to the centre of the bottom frame on each side and end. The top frame and springs are then covered over with strong canvas, and tacked firmly to the frame, forming an even surface to receive the stuffing, which is to consist of hair, wool, cotton, or any other article usually adapted for the purpose, and is finally completed by an outside covering of ticking or other suitable material drawn evenly and tightly over the stuffing, and tacked to the outside edge of both top and bottom frame, and also tufted, or otherwise, as may be required or found necessary. For the purpose of raising the head of the mattress and giving it greater inclination, two leather straps and buckles are placed one at each side near the foot, so as to draw the two frames together, thereby giving the inclination best suited to the occupant, being particularly adapted for invalids. *Patent completed.*

401. J. S. GISBORNE and W. SIMPSON. *Means of rendering ships and other compasses insensible to local attraction.* Dated February 14, 1863.

This invention consists in passing a current of electricity from an ordinary battery through a coil of insulated copper wire wound around a hollow, conical, or semispheroidal compass box, or wound round a hollow, conical, or semi-spheroidal shaped dish encircling the compass box. In either of these arrangements the magnetic needle rests on a centre pin, or, when there are more than one, they are secured to the card or other part which rests on the pin in any usual way at a short distance below a straight line drawn horizontally across the upper termination of the said coil, and below the mouth or termination of the conical or semispheroidal shaped box or dish, the leading features of construction of compasses at present in use being retained. *Patent completed.*

402. H. DEMBINSKI. *A motive apparatus, and processes proper for giving to it a continuous motion and unlimited strength.* Dated February 14, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

403. W. BAYLIS and T. H. HOPWOOD. *Improvements in tongs or forceps for grasping articles out of reach of the hand.* Dated February 14, 1863.

This invention is not described apart from the drawings. *Patent completed.*

404. W. WOOD. *Certain improvements in cutting or producing screws or threads, and in apparatus connected therewith.* Dated February 14, 1863.

This invention relates to the cutting or formation of such screws, worms, or similar helical threads as are termed male or external screws. The apparatus consists in a novel arrangement of, and improvements upon, the well-known "stocks and dies," and is designed to render one "stock" available for three or more "dies." The improvements consist in the employment and use of equilateral triangles, or two four-sided pieces of metal, each side of which is to contain one-half of the screwing "die," so that, when two corresponding sides are brought together, the die will be formed at the middle or division when the two pieces come in contact, the triangular pieces being secured to a back plate by a central screw through each. A second part of the invention consists in a novel arrangement of apparatus for tightening and adjusting the "dies" as now employed in ordinary "stocks and dies," and which is also applicable to the adjustment of the before-mentioned four-sided pieces. At the end of the opening in the stock wherein the "dies" fit, a narrow slot is formed to receive a moveable nut, within which a screw works, terminating in a head which abuts against the back of the sliding "die," so that, by turning the screw out of the nut, pressure is exerted on the die, the nut and screw being readily displaced for the ready substitution of another die. *Patent abandoned.*

405. J. LEWIS. *Improvements in driving sewing machines.* Dated February 14, 1863.

This invention consists, principally, in driving sewing machines by means of coiled springs, or by coiled cords, chains, and weights, instead of driving them by means of a treadle worked by the foot, or by steam, or other similar power, as hitherto practised. *Patent abandoned.*

406. J. H. WALSH. *Improvements in breech-loading fire-arms, and in the cartridge cases to be used therewith.* Dated February 14, 1863.

This invention consists in a mode of opening and closing the breech without depressing the barrel, or thrusting it forwards, and yet allowing the cartridge to be pushed in straight from behind; and in the adaptation of a cartridge extracting power, quite independent of the barrel, and not, therefore, weakening the latter by cutting a slot therein, as is the case with ordinary extractors. The novelty in the cartridge case consists in clothing it with a thin layer of paper, silk, or other fibrous material, attached by a new compound, and in the peculiar arrangement of the nipple cover. The attachment of the hammer to the striking pin is also carried out in a novel manner, so as to draw back the pin without impeding the full blow of the hammer. *Patent abandoned.*

407. J. THORNE. *Improved apparatus for disengaging ships' boats.* Dated February 14, 1863.

This invention is carried out in the following manner:—To the keel of the boat two sockets are firmly bolted, and into these sockets are passed the lower ends of two suspending rods, the ends being formed with long slots, and the sockets provided with bolts passing through the slots in such a manner as to allow of the suspending rods having a certain amount of vertical motion in the sockets, but not of their being withdrawn entirely. At the upper end of each suspending rod is a slip hook, which is kept closed by a guard link attached by a rod to the socket, and sliding on the suspending rod. The boat is supported by passing two hooks attached to two blocks (running in the bight of the davit tackle falls) into the slip hooks at the upper ends of the two suspending rods. The stem and stern of the boat are supported by means of links or rods connecting them respectively to the slip hooks. When the boat is hanging at the davits, the suspending rods are held fast in the sockets by means of two locking bolts, both connected to one rod, the end of which is attached to a lever in the stern or other convenient part of the boat. When the boat is lowered into the water, upon pulling this lever, both bolts are simultaneously withdrawn, when the suspending rods slide in the sockets just sufficient to draw the guard links off the ends of the slip hooks, thus instantaneously disengaging the boat from the falls at both ends. *Patent abandoned.*

408. W. CLARK. *Improvements in the method of, and apparatus for, separating the fibres of straw, wood, and other vegetable substances, and extracting the gummy and colouring matters therefrom, to render them fit for paper stock, or for other purposes.* (A communication.) Dated February 14, 1863.

This invention relates to the separation of the fibres of vegetable substances, and the extraction of their gummy and colouring matters, by subjecting them to the action of water, brought to a temperature at which it boils under a pressure greater than that of the atmosphere, either with or

without the use of alkalies, or of rubbing, grinding, or beating devices, as an aid to maceration. *Patent completed.*

409. A. J. FRASER. *Improvements in window furniture or fastenings.* Dated February 14, 1863.

This invention consists of a metal or other suitable ratchet toothed rack, which the inventor applies to the inside of the window frame; this extends from top to bottom of the sash, one for each sash. This rack has its ratchet teeth so disposed that the horizontal part of each tooth is above. On the window sash he applies a spring bolt, which is so fixed as to abut its end against the rack, and by the pressure of its spring is kept up thereto, and is at the same time free to recede. The effect of this bolt is, that on raising the sash, the bolt slips over the inclined faces of the teeth, freely catching at each one, and preventing the sash again descending from any intermediate distance to which it may be raised, or at the full height. Thus, in opening a window, it is simply necessary to lift the window to the required height. If it be desired to lower the window, it is simply necessary to withdraw the bolt from contact with the rack teeth, and lower it down when closed. A hole is provided in the rack at that point to receive the end of the spring bolt, which shoots into such hole, and prevents the window from being again raised until the bolt is withdrawn, which, of course, can only be done from the inside. If it be desired to fix the window sash open a few inches, so that it cannot be further opened from the outside, he adds another bolt at the top of the sash, which is shot into one of several holes which receive it, and secure the window sash at the height desired. The advantage of this mode of fixing and supporting window sashes are—that the window cannot be opened from the outside, and that the counter-balance weights and boxes may be dispensed with for ordinary windows. *Patent abandoned.*

410. J. and H. HIGGINS. *Improvements in carding engines and in apparatus connected therewith.* Dated February 14, 1863.

The patentee claims—1, separating the impurities from the strippings of working rollers of carding engines, and conveying the cleaned material again to the main cylinder; 2, the application of a knife or blade, or a series of knives or blades, as described, to the clearers of working rollers of carding engines, for the purpose of conveying the impurities detached from such cleaners to the "licker-in," or to a roller where they are collected on its surface; 3, the mode described of driving the coiler shaft, and the employment of a strap which is shifted on to a loose pulley when the coiler shaft is required to be stopped; 4, the application of a second bearing to the brackets or stands of grinding rollers, for the purpose set forth; 5, attaching cylinders or rollers to their ends by contraction of the metal consequent upon cooling. *Patent completed.*

411. F. E. WALKER. *Improvements in the construction of breech-loading firearms.* Dated February 14, 1863.

This invention relates to a new construction and arrangement of the breech or action, and to a new and improved method of locking and opening the barrels of breech-loading guns, with which the cartridges known as the "Lefaucheux" cartridges are used. The improvement in the body of the action is such that the metal portions are so arranged and placed, that the gun-locks employed therewith may be of the bar pattern, "jointed" or fitted to the barrels and false breech, as in the muzzle-loading gun. The action is let into the stock, leaving the wood on each side, so that the locks may be let into the wood also, as in an ordinary muzzle-loading gun. The locking part consists of a steel tumbler carried by a pin, which passes through the body of the action, and the said tumbler has a lever or handle attached thereto, which, when the gun is closed, partly covers the guard of this gun, and by means of this lever giving motion to the tumbler, the barrels are opened or closed. A link connects the lever and the barrels in such manner that, by moving the lever forwards or backwards, the barrels are opened or closed, and when the lever is moved into position with the guard, the gun is locked securely, and in a more simple manner than by the means heretofore employed for this purpose. A safety is employed in combination with the parts previously described, whereby the triggers are firmly locked when the lever and tumbler are out of position, the stop or bolt of the safety being moved back when the lever is moved fully into position again over the guard. A spring catch or other simple fastening may be employed to secure the lever to the guard, or otherwise when the parts are closed. *Patent completed.*

412. J. MORGAN. *Improvements in embalming and preserving from decay human bodies and bodies of other animals; also pickling, curing, and flavouring animal bodies.* Dated February 14, 1863.

This invention consists in introducing into animal bodies preservative fluids, by means of the natural channels of the circulation, whereby structures are permeated by the fluids, whether for preservation for the purpose merely of embalmment, as in the case of human bodies where poisonous solutions may be used for the purpose of the dissecting room, or preservation in sealed cases of glass or other material in place of coffins, to be kept in mausoleums, vaults, or otherwise. It [illegible] consists in preserving, curing, or preparing animal b[illegible]tended to be used for food, such as beef, swine, and all the mammalia and birds (as well as the lower animals in some instances), by impregnating their bodies with salt, salt and saltpetre, salt and muriate of ammonia, or other salts, sugar, treacle, materials for preservative flavouring, colouring, medicating, and other purposes. The patentee proposes by this process to cure and preserve not only the bodies, but the hides of animals where it is desired. *Patent completed.*

413. J. H. JOHNSON. *Improvements in wrought-iron casements, and in the means for fastening the same, which improvements are also partly applicable to the framework of glass doors, conservatories, and similar structures.* (A communication.) Dated February 14, 1863.

In carrying out this invention, as applied to a French casement, the two side frames are rolled of an angled form, and have strips of wood secured to them which fill in the aperture in the masonry to which they are to be applied. The bottom of the sash frame consists of a bar curving outwards, so as to carry off the rain, and is secured at each end to the side frames by rivets, a similar mode of attachment being employed in securing the ends of the top part of the frame, which is in the form of a flat bar, having a raised rib or web rolled thereon near its lower edge on the inner side. Each sash is hinged to the frame by having tubular sockets screwed thereto, which drop into hinge pins in the frame, a hinged piece capable of being turned up when required serving to lock the sockets down upon the pins, or to release them when the sash is to be lifted off its hinges. The bottom bar of the sash is connected with the vertical bars by a mortise and tenon joint, and a somewhat similar plan is adopted in the upper bar, which plan is also used for the intermediate bars. The bottom bar curves outwards so as to throw off the rain, and a flat grooved bar is rivetted to it, which closes against and interlocks in the bottom bar of the window frame, a strip of india rubber being interposed to keep the sash weather-tight. The outer edges of the vertical sash bars are rebated, so as to close over two faces of the side bars of the frame, and the two adjoining vertical sash bars are bevelled in order to fit accurately together when the casement is closed. A longitudinal groove or channel is made in one of these bars, into which a strip of india rubber is inserted, for the purpose hereinbefore described, a corresponding rib and groove on the opposite bar locking into and bearing upon the india rubber in the groove of the bar last referred to. The window frame is kept closed by an "espagniolette," or French casement fastening, the rod of which is fitted to the sash frame by means of two hinges let into the frame. It is provided at the top and bottom with a hook, which hooks, when closed, engage into corresponding notches in pieces attached to the opposite sash. Through the centre of the rod is passed the spindle or axis of the handle, on the end of which is fitted a latch which, when the handle is in a vertical position, presses upon the vertical bar of the opposite sash, and thereby causes the two sashes to bear throughout their entire length against the sash frames. *Patent completed.*

414. M. OBREN. *Improvements in the construction of gasholders and in the mode of rendering gasholders self-acting.* Dated February 16, 1863.

Great inconvenience (and often danger) arises from closing the wrong valve in changing from one gasholder to another, and more especially from a heavy one to a light one, for, on opening the inlet of the light one the gas from the heavy one passes into it before the outlet of the heavy one is closed. These difficulties may be avoided, and the gasholders rendered self-acting, by fixing to the guide bars of the gasholder, to the columns thereof, or to the gasholder, or to any other convenient and suitable place, stops or guards, either at the top or bottom of the same, to catch the guide rollers or other portion of the gasholder, so as to stop the ascent of the gasholder on reaching the required height; the valves of all the inlets and outlets of the gasholders being open the lightest gasholder will fill first, then the next lightest, and so on in succession, until the whole of the gasholders in action are filled; during the supply the heaviest gasholder will discharge first. This mode of construction or adaptation will answer for any number of gasholders, however far apart, care being taken to stop off each gasholder with sufficient seal, with the exception of the heaviest one, which should not be stopped off at all, so that it may "blow" when all the gasholders are full. The inlets and outlets being all open, any increase in the bulk of a full gasholder in sunny weather will pass through the outlet, and go away with the "make" to the gasholder then filling. *Patent abandoned.*

415. J. W. CROSSLEY. *Improvements in press papers, and in the method or means of drying them and other similar sheets of paper, applicable also for the drying of woven fabrics, yarns, wool, cotton, or other fibrous substances.* Dated February 16, 1863.

This invention consists—1, in having press papers coated or covered with tin foil or other metal in thin leaves or layers, or an alloy of tin and any other suitable metal, or with other alloys, mixtures, or amalgams capable of producing metallic surfaces thereon. The second part of the invention consists in the employment of a series of cylinders heated by steam, or other heating media, and two endless aprons or cloths which pass over or partly around and in contact therewith, in such manner that press papers or other sheets of paper may be placed betwixt and carried or conducted thereby over and around or in near contact with each of the said cylinders in succession by which they are dried. The said series of cylinders or drying machine the patentee encloses to prevent radiation of heat, and he has a chimney or opening at the top (which may be connected by a pipe to the boiler chimney, with openings at the bottom to admit air, which may be first heated), by which means a current will be produced betwixt the cylinders, carrying off the vapours, thereby materially assisting in the process of drying. *Patent completed.*

416. C. D. ABEL. *An improved omnibus.* (A communication.) Dated February 16, 1863.

The patentee claims the construction of omnibuses having a double body or two compartments side by side, and carried by two sets of three wheels, one of each set being of a large diameter and placed centrally, so as to run in grooves formed between the two compartments. *Patent completed.*

417. Mr. C. MCENTEO and T. WITHERS. *Improvements in locks.* Dated February 16, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

418. J. B. WATTS. *Improvements in the manufacture of matchets and swords.* Dated February 16, 1863.

In carrying out this invention, the inventor employs bars of steel of the kind commonly employed for the manufacture of matchets, and known in commerce as matchet steel. The said matchet steel is about the width of the matchet to be made, and is rolled of the form of the middle part of the blade of a matchet. The said matchet steel is cut into the required lengths by oblique cuts or divisions, and one end of each piece of steel is formed into the tang, and the other end into the point of a matchet by means of rolls. The tang is formed at that end of the piece of steel which forms an obtuse angle with the thick or back edge of the said piece of steel. In forming the said tang the inventor employs a pair of rolls, one or both of the said rolls being slightly eccentric to their axes; one of the said rolls has a portion of its cylindrical surface cut away to permit of the introduction of the piece of metal between the rolls. The heated end being passed between the rolls, the thick or back edge is elongated more than the thin edge, and the tang edge is thus made of nearly the same thickness, and of nearly the same length, on both edges. The tang is completed in the ordinary manner. In making the point end of the matchet, he first flattens and tapers the back edge by cross-rolling, and afterwards curves the required part of the matchet. This he effects by means of rolls, the acting surfaces of which are slightly inclined to one another. In inserting the piece of steel between the rolls, the edge which is to be curved of a convex figure is turned towards the ends of the rolls where their surfaces are nearest together. The matchet is finished in the ordinary manner. He forms the points of swords by the process described with reference to the points of matchets. *Patent abandoned.*

419. H. SMITH. *Improvements in apparatus for feeding horses.* Dated February 16, 1863.

This invention consists in arranging and applying apparatus to mangers, or to the troughs or vessels where horses are fed, in order that the food may be gradually supplied by a measured time to such mangers, troughs, or vessels, and so as to allow and ensure a reasonable time for the horses to eat their food. The arrangement of apparatus employed in carrying out this invention may be varied, but it is preferred to have a tube or shoot to each manger or vessel descending from a hopper or other containing vessel wherein the quantity of food for a feed is placed, and from which it is allowed to descend into the manger, trough, or vessel, the descent or speed of supply being regulated by a valve or slide, or other instrument, the action of which may be regulated by a falling weight or spring, or by other suitable means. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated June 27, 1863.

1615. G. Clark, 30, Craven-street, Strand, gentleman. Improvements in the construction of guns and projectiles, and of carriages, platforms, and shields for working and protecting guns.

Dated July 22, 1863.

1834. C. Senior, Dead Waters, near Huddersfield, engineer. Improvements in means or apparatus for closing, punching, and rivetting hose-pipes of leather or other substances, applicable also for punching and rivetting mill bands or driving straps, and similar purposes.

Dated July 28, 1863.

1870. M. Cockerill, 3, Munden-terrace, Hammersmith. The improvement of mortise and other door locks and latches.

Dated August 6, 1863.

1937. J. E. Dowson, 4, Victoria-street, Westminster. A new application of rolled metal plates to the formation of roadways, bridges, tramways, and other structures.

1943. W. Clark, 53, Chancery-lane, engineer. Improvements in taps or stopcock apparatus. (A communication.)

Dated August 10, 1863.

1967. J. A. Fullerton, Manchester, iron merchant. Improvements in the method of fastening hoops for packing bales, and in the machinery or apparatus employed therein.

Dated August 17, 1863.

2038. H. A. Bonneville, 24, Ru du Mont Thabor, Paris, France, and 38, Porchester-terrace, Bayswater. Improvements in engraving. (A communication.)

Dated August 18, 1863.

2044. J. Broadley, Saltaire, near Bradford, overlooker. Improvements in means or apparatus employed in weaving.

Dated August 21, 1863.

2077. R. Thompson, New Charlton. Improvements in machinery for planing curved, curvilinear, irregular, and other forms in iron, steel, and other metals.

2082. J. B. C. Lange, Paris, householder. An improved apparatus for indicating or registering the speed or distance travelled by vehicles, carriages, and such like, which said apparatus is also applicable to engines, water-wheels, and prime motors of any description.

Dated August 25, 1863.

2099. A. Hett, City, doctor of medicine, and F. W. Basset, Camberwell, civil engineer. Improvements in preserving animal substances, and animal and other substances used for food.

Dated August 26, 1863.

2106. J. L. Kessler, Paris, France, engineer. Improvements in apparatus for evaporating and distilling.

2107. S. Fattorini, 3, Rue Joubert, Paris, optician and mathematician. A new division of time, and the application thereof to mathematical and other instruments.

Dated August 27, 1863.

2118. J. Ward, Liverpool, merchant. Improvements in diving apparatus.

2120. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in breech-loading firearms. (A communication.)

Dated August 28, 1863.

2122. G. Davies, Serle-street, Lincoln's-inn, civil engineer. Improvements in the manufacture of iron and steel from the cinders and refuse of puddling and other furnaces, and from certain kinds of ores. (A communication.)

2124. J. Shaw, Junction Implement Works, New Wortley, Leeds, implement maker. Improvements in machines for cutting or reducing turnips or other roots as food for animals.

2126. E. Amourous, 4, South-street, Finsbury, gentleman. Improvements in apparatus for separating solid from fluid fecal matters.

2128. J. Alison, Reigate, gentleman. Improvements in apparatus for tilling land, which improvements are chiefly applicable when steam power is employed.

2130. J. Walls, Farington, near Preston, engineer. Improvements in steam boilers, and in apparatus connected therewith.

Dated August 29, 1863.

2134. T. Williams, Manchester, tobacco manufacturer. Improvements in machinery or apparatus for crushing and flattening the stalks of tobacco and other substances.

2138. D. Speirs, manufacturer, A. Boyd, pattern maker, and J. Kirkwood, weaver and mechanic, Paisley. Improvements in looms for weaving.

2140. F. C. P. Hoffmann, Newgate-street, engineer. Improvements in shears for cutting metal and other substances.

2142. A. Rowland, Glasgow, merchant. Improvements in evaporating fluid solutions, and in the machinery, apparatus, or means employed therein.

2144. L. E. C. Martin, 32, Albion-street, Hyde-park. Improvements in apparatus for generating steam and for generating gases to be used for heating steam boilers, and for other purposes.

Dated August 31, 1863.

2146. H. E. Kramer, Leipsic, Saxony, printer. Improvements in printing in colours pictures or devices to be used in ornamenting porcelain, stoneware, earthenware, or any other substances where the colours can be annealed or melted or burnt in.

2150. W. E. Gedge, 11, Wellington-street, Strand. An improved watch. (A communication.)

2154. G. B. Pettit, Oxford-street, gas engineer. A method of preparing mica and talc in order to render them applicable to articles of wearing apparel and to ornamental purposes.

Dated September 1, 1863.

2162. G. T. Bousfield, Loughborough-park, Brixton. Improvements in the manufacture of illuminating gas. (A communication.)

2164. G. W. Ewens, Sherborne-lodge, Doris-street East, Kennington-cross. Improvements in the manufacture of wadding paper and felted fabrics, and in the preparation of vegetable fibres to be used in such manufactures.

Dated September 2, 1863.

2166. J. Lewis, Manchester, engineer. Certain improvements in machinery or apparatus for preparing and drying clay, and also in machinery to be employed in the manufacture of bricks and tiles.

2170. C. H. Corlett, Güstrow, in the Grand Duchy of Mecklenburg Schwerin, civil engineer. Improvements in valves, taps, or cocks.

2172. F. C. P. Hoffmann, Newgate-street, engineer. Improvements in machines for crushing hard substances, for washing ores and minerals, and for separating earth and earthy matter from solid substances.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, September 15, 1863.

1098. W. G. Craig. Steam boilers. (A communication.)
1107. J. T. and T. Oakley. Pumps.
1109. E. R. Southby. Extraction of scents.
1110. J. Fortune. Joining or fastening together lace, blond, quilling, or similar materials.
1116. W. Walsh. Obtaining and purifying oxalate of soda.
1122. P. Bradshaw. Mounting or hanging millstones for grinding grain.
1123. J. H. Knott. Pumps.
1126. S. B. Cochran. Sewing machines.
1127. T. Sagar and J. Wilkinson. Power looms.
1131. S. D. Mac-Kellen. Watches and other timekeepers.
1134. T. Beesley. Construction of boxes or cases for carrying and packing bottles.
1143. G. Bower and A. Dick. Purification of gas.
1145. J. Bettridge. Ornamentation of papier maché or other japanned wares.
1149. P. J. Livesy. Compound steam engines. (A communication.)
1151. H. Schooling. Moulding or shaping lozenge paste or other plastic materials.
1153. C. L. Braithwaite and J. Hurst. Machinery for feeding slivers of wool.
1157. E. C. Boët. Tanning hides and skins. (A communication.)
1164. J. Noire. Making moulds.
1172. J. Burrell. Machinery for cutting the teeth of bevelled wheels.
1174. J. Burrell. Salinometers.
1177. B. Hargreaves. Tiles for drainage or sanitary purposes.
1187. B. Dilly. "Snap-caps" or "nipple protectors."
1224. A. Macmillan. Buttons, and fastening buttons to garments.
1231. R. Talbot. Rudder.
1234. J. T. Newton. Planishing and rolling sheet metal.
1268. J. Cassell. Mineral oils and hydro-carbons. (A communication.)
1270. W. Walker. Looms.
1275. N. J. Amies. Elastic webbing.
1288. W. E. Newton. Waterproof fabrics. (A communication.)
1289. W. E. Newton. Waterproof fabrics. (A communication.)
1327. W. E. Newton. Separating the fibre from the flesh of plants. (A communication.)
1369. A. V. Newton. Marline spike. (A communication.)
1448. M. Hatschek. Mashing.
1466. G. Davies. Currying and finishing of leather. (A communication.)
1487. I. G. and W. Bass. Manufacture of nails and spikes.
1731. R. and W. Hawthorn. Working of railways.
1791. N. Thompson. Boat-building, and machinery for shaping wood therefor.
1807. F. J. Mavor. Horse shoes.
1962. J., J., A., and W. Thorton. Apparatus for producing looped fabrics.
2059. T. Howard. Spinning fibrous substances.
2072. W. E. Newton. Manufacture of cartridges. (A communication.)
2087. L. E. C. Martin. Heating and purifying water.
2095. A. Capello. Glazing leather.
2102. J. W. Friend. Gas meters.
2144. L. E. C. Martin. Generating steam and gases to be used for heating steam boilers, or for other purposes.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed September 11, 1863.

608. P. Adie.
663. J. Cassell.
665. W. R. Mulley.
666. H. Wilson.
672. J. Renshaw.
673. W. Rossetter.
674. F. B. Kraushaar.
675. H. D. and J. W. Taylor.
679. J. Polkinghorne.
680. H. B. Barlow.
687. J. H. Johnson.
692. J. Page.
695. R. Alexander.
699. J. Walworth.
703. T. W. Willett.
709. W. G. Eavestaff.
712. W. H. Atkinson.
713. W. E. Gedge.
715. J. Cox.
719. W. Symington.
720. W. O. Wild and J. H. Randel.
721. W. Donbavand and D. Crichton.
723. R. A. Brooman.
724. F. R. H. Chandler and J. G. Richmond.
727. B. Wren.
729. T. Oldknow.
737. H. O. Haughton.
751. J. Brigham and R. Bickerton.
767. W. Clark.
773. A., J., and J. Topham.
790. M. L. Parnell.
807. J. King and T. H. Marshall.
832. H. Hamer.
833. J. M. Dunlop.
838. M. Henry.
881. A. V. Newton.
902. A. V. Newton.
904. A. V. Newton.
1035. L. A. J. Brust.
1066. J. H. Johnson.
1071. G. Davies.
1194. H. L. Emery.
1376. D. Wilson and E. A. Cowper.
1424. W. E. Newton.
1574. C. T. Burgess.
1642. H. Hutchinson.
1690. G. P. Reed.
1702. W. E. Newton.
1726. R. Hornsby, jun., J. Bonnall, and W. Astbury.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2184. T., E., and J. Thornton.
2193. R. C. Clapham.
2202. F. A. N. Frepper.
2205. R. H. Gratrix and M. P. Javal.
2207. J. Wright.
2209. N. Thompson, jun.
2210. A. Ransford.
2225. J. Petrie.
2233. R. Mushet.
2247. J. M. Napier.
2280. M. Sautter.
2344. T. Brookes and T. Adams.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2126. J. Milnes and W. Thompson.
2149. C. Hill.
2113. J Taylor.
2142. E. Green.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated September 3, 1863.

2179. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. An improved mode of attaching horses to carriages or other vehicles, and apparatus therefor. (A communication.)

2180. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. An improved machine for glossing and glazing all kinds of threads. (A communication.)

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending September 12, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
182	0 4	244	0 4	256	1 2	268	0 4	280	0 4	293	0 4
186	0 4	245	0 4	257	1 0	269	0 4	281	0 4	294	0 6
188	0 4	246	0 10	258	0 10	270	0 8	282	0 10	295	0 10
202	0 4	247	0 4	259	0 8	271	0 4	283	0 4	296	1 8
207	0 4	248	0 10	260	0 10	272	0 6	284	0 4	297	0 4
234	0 4	249	0 8	261	0 10	273	0 10	285	0 4	298	0 4
235	0 4	250	1 10	262	0 8	274	2 0	287	0 4	299	0 10
237	0 6	251	0 6	263	2 2	275	0 4	289	0 4	300	0 4
238	0 4	252	1 6	264	0 8	276	0 8	290	0 4	301	1 0
241	1 8	253	1 10	265	1 2	277	0 4	291	0 4	302	0 4
242	0 4	254	1 0	266	0 4	278	0 4	292	1 2	303	0 4
243	0 10	255	0 8	267	0 4	279	0 4				

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p. ct.
IRON:—									
Welsh Bars, in London	per ton	7	10	0	to	8	10	0	2½
Nail Rods	do	8	0	0		8	10	0	
Hoops	do	9	0	0		9	10	0	
Sheets, single	do	10	0	0		10	10	0	
Staffordshire Bars	do	8	5	0		8	10	0	
Bars, in Wales	do	6	10	0		6	15	0	
Rails	do	6	5	0		6	10	0	nett
Foundry Pigs, at Glasg. No 1	do	2	16	0		3	0	0	
Swedish Bars	do	11	10	0		12	0	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		18	5	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	102	0	0		0	0	0	
Hammered Bottoms	do	112	0	0		0	0	0	
Flat Bottoms, not Hamrd.	do	107	0	0		0	0	0	
Tough Cake and Ingot	do	95	0	0		0	0	0	
Tile Copper	do	98	0	0		0	0	0	
Best Selected	do	98	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8¼		0	0	8¾	
Fine Foreign	per ton	98	0	0		100	0	0	
TIN:—									
English Block	per cwt.	5	15	0		0	0	0	2½
do Bar	do	5	16	0		0	0	0	
do Refined	do	6	0	0		0	0	0	
Banca	do	6	3	0		0	0	0	
Straits	do	5	15	6		0	0	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	8	6		1	9	0	
Second Quality	do	1	7	0		1	7	6	
Coke	do	1	3	0		1	4	6	
LEAD:—									
Pig, English	per ton	21	7	6		21	10	0	
" Spanish Soft	do	19	7	6		19	10	0	
Shot, Patent	do	23	10	0		0	0	0	
Sheet	do	21	0	0		0	0	0	
White	do	27	0	0		27	10	0	
SPELTER:—									
On the spot	do	18	15	0		0	0	0	nett
ZINC:—									
English Sheet	do	23	0	0		21	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	38	0	0		0	0	0	

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.
Teak ... load	£12	0	£13	0
Quebec, red pine	3	10	4	10
" yellow pine	3	10	4	10
St. John, N.B., yellow	0	0	0	0
Quebec oak, white	5	10	6	10
" birch	3	10	4	10
" elm	3	10	5	0
Dantzic oak	3	10	6	10
" fir	2	10	3	10
Memel fir	3	5	3	10
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
" yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
" St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	18	10
St. John, white spruce	14	0	15	10
Yellow pine, per reduced C.				
Canada, 1st qual.	17	0	18	0
" 2nd do.	11	0	12	0

	£	s.	£	s.
Archangel, yellow	£13	0	13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
" white	9	0	9	10
Gefle, yellow	10	10	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12ft by 3 by 9 in.				
Christiania, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	1
PUMICE STONE pr ton	5	10	9	0
OILS, &c.				
Seal, pale ... per tun	46	0	0	0
Sperm body	80	0	0	0
Cod	55	0	52	10
Whale, Sth Sea, pale	42	0	43	0
Olive, Gallipoli	60	0	0	0
Cocoanut, Cochin	47	0	47	10
Palm, fine	35	10	36	0
Linseed	41	0	0	0
Rapeseed, Eng. pale	45	0	0	0
Cottonseed	33	0	40	0

FRENCH & SMITH, Sworn Brokers,
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4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number.— PAGE

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 25, 1863.

AMERICAN HEAVY ORDNANCE.

THE construction of heavy ordnance suited to meet all the requirements of practical warfare, presents one of the most difficult problems which task the inventive powers of the men of the 19th century. The solution of any question depends on the accurate understanding of everything connected with it; and even comparative ignorance on any one division of a subject must materially invalidate the results obtained by calculation or experiment from the rest. We know a great deal about the strength of materials, the action of gunpowder, the flight of projectiles, and the exigencies of actual service; but we do not yet know enough, and as a result, we have failed in the construction of exceptional guns. We do not possess at the present moment a single gun capable of throwing a shot over 100 lb. weight, which is thoroughly reliable, or on which we could depend for half an hour in action. Not only the manufacture, but the working of large guns, even of the simplest form, is attended with difficulties of the gravest kind. And these obstacles to the general introduction of heavy ordnance, are increased a hundredfold by complicated breech-loading machinery, deemed indispensable, obtained at a vast expense, and usually found wanting in the day of trial. The largest guns ever used are at present to be found in the American navy. We referred last week to some of the practical details of their manufacture; and the subject is so important, that we willingly return to it, believing as we do that information concerning it, is of very great importance as a guide to our future proceedings.

The breech-loading principle is generally ignored throughout the States. A few small guns on Whitworth and Armstrong's principle, or something analogous, may, it is true, be found in both the contending armies. Our American friends do not believe in them, however, and eschew them when they can obtain anything else. The favourite naval guns are Parrott's and Dahlgren's; the latter are pretty well known. The most usual size is the 8 in. shell gun, with a length of bore of 100·3 in.; weight, 63 cwt. These guns, placed 9 ft. above the level of the water, throw a shell 1,776 yds. at 5 deg. elevation, with 9 lb. of powder. Much less is known of the Parrott guns; and as they are beyond dispute the best in the American navy, we do not hesitate to give our readers some information regarding them, on the accuracy of which we can implicitly rely.

The Parrott guns are usually made of the sizes 100, 200, and 300-pounders. The first has a bore 6·4 in. in diameter, and 130 in. long. The usual weight of this arm is 9,700 lb. The charge consists of 10 lb. of powder, and a conical projectile weighing 100 lb. The rifling consists of ten grooves, one-tenth of an inch deep, and exactly an inch wide. The lands and grooves are, as a principle, made as nearly as possible of the same width, no matter what the dimensions of the gun. The 200-pounder weighs nearly 8 tons, is 136 in. long, 8 in. bore, throwing a 150 lb. to 175 lb. shot with 16 lb. of powder. The bore is rifled with 11 grooves, similar in every respect to those of the 100-pounder. The 300-pounder 10-in. gun weighs over 11 tons, has a bore 144 in. long, and throws a 250 lb. shot with 25 lb. of powder; 14 grooves. The twist of the grooves is rather slow, being—in the 100-pounder, one turn in 18 ft.; in the 200-pounder, one turn in 23 ft. We cannot state the precise twist of the largest Parrott guns; but we believe it to be the same as that employed in the 200-pounder. The range of the 100-pounder is 5 miles, with 38 deg. of elevation, and the service charge.

The Parrott shot is a conical projectile, with rather a sharp head. It fits the chase of the gun pretty accurately, resting on the lands. A dove-tail groove is turned in the hinder end of the shot, about 2 in. wide and rather more than an inch deep towards the forward end. Into this groove is cast a ring of soft brass. The surface of the groove is "pecked" or roughened all over, so that the ring—which is just the size of the bore of the gun—cannot turn on the shot. The explosion of the charge "upsets" the brass ring into the shallow grooves, imparting a motion of rotation to the shot. Any effect similar to "leading" is of course impossible, and the gun is in consequence loaded with as much ease as a smooth-bore, while the brass sabot effectually precludes windage; being upset so thoroughly as to fit the bore mathematically, without any injurious friction. To this, doubtless, the vast range of the gun, with small charges, is directly attributable. Parrott ordnance is invariably constructed of cast iron, usually on the "Rodman" principle, already referred to in our previous number, strengthened with a reinforce, composed of a single-lap welded wrought-iron ring, extending from the breech to within a foot of the trunnions. It must be remembered that the gun is not cut away to receive the reinforce, which is shrunk on hot, turned and finished afterwards. Ordinary percussion fuses have been hitherto used for the shells. The great success of those guns, the facility with which they are loaded, their vast range and great accuracy, entitle them to a first rank as a military or naval weapon, and demonstrate clearly, that enormous charges of powder are quite unnecessary to the performance of a rifled cannon, when the proper conditions, regulating the flight of the projectile and its passage through the bore of the gun, are carefully observed. The employment of large quantities of powder is simply a clumsy expedient to counteract the evils resulting from an improper system of rifling and a faulty construction of shot. Large cannon never can succeed while the powder burned at each discharge is as much as one-third or one-fourth of the weight of the projectile. So thoroughly imbued with this conviction are American artillerists, that they have initiated some very remarkable experiments, with a view to concentrate the force of reduced charges of powder on the projectile with a proportionate diminution of the strain on the gun. A 7-in. gun was loaded with the full charge of powder, made up in a cartridge, 6 in. in diameter; so prepared, that when placed in the gun, a clear space of half-an-inch remained all round, between its circumference and the chase. The shot was then rammed close home on the cartridge, and the gun discharged with the following remarkable result. The initial velocity of the shot remained precisely the same, as though discharged in the ordinary way, while the strain on the gun was reduced nearly one-half as evinced by the pressure plug at the breech! Repetition has only confirmed the truth of the result obtained by the first experiment. The air cushion left between the powder and the bore, apparently protects the gun from the percussive force of the exploding powder, to which the shot is, of course, fully exposed. The entire phenomena afford a remarkable confirmation of the truth of the views expressed by Mr. Lynall Thomas on the action of exploding gunpowder. We have no doubt that the conduction of a similar series of experiments in this country would be fraught with the best results. After all, our Government has done little or nothing to determine the best form for a gun externally, or the real action of the gunpowder exploded within it. All the information we have on these subjects is due, in a primary degree, to private individuals; those having authority confining their attention almost exclusively to the rifling, the shot, and the mode of loading, while the resisting powers of the gun have either been left to chance, or sought for in the use of better material, almost without regard to its proper distribution. Dahlgren literally took a diagram of the forces developed within his first guns by drilling a number of small holes in a continuous line from breech to muzzle, in the side of a gun. Each of these holes was fitted with a pistol barrel or tube, screwed in, of such length that the distances from the bore of the cannon to the ends of the tubes were all precisely alike. These tubes were each loaded with a single ball, which, on the discharge of the cannon, was expelled with a force proportionate to the pressure of the gases at each part of the length of the gun. This force was measured by the depth to which the pistol balls penetrated an oak screen suitably placed to receive them. In one experiment the force was found to equal 3,000 lb. on the square inch close to the muzzle of an 8-inch gun with the service charge of powder and shot. The great efficiency to which American ordnance has attained is certainly due to a carefully conducted series of experiments, commenced years ago and continued to the present moment. The admirable simplicity of the service guns renders them thoroughly reliable, while the cost of their manufacture is extremely moderate.

Quitting the subject of rifled guns, we find much to interest in the colossal smooth-bores which perform their duties on the decks of the "Monitor." These guns are 13 ft. long in the bore, and carry a 15-in. spherical shot, called solid, but really containing a cavity 4 in. in diameter, which secures the solidity of the iron surrounding it by equalizing its contraction. These projectiles weigh 425 lb. The service charge of cannon powder is 35 lb. only, but cake powder is sometimes employed in 50 lb. charges. 15-in. shells weigh 350 lb. The initial velocity of shot thrown from these guns seldom exceeds 1,000 ft. per second; in consequence, they are far more terrible in name than in reality. The turrets in which they are placed are built up of a large number of superimposed iron plates, seldom more than 1 in. thick each. The concussion of heavy shot striking them occasionally drives the nuts off the bolts which bind the plates together, killing or wounding those within the turret as effectually as so much shot. The 15-in. guns are mounted on a heavy wooden carriage, much like the old-fashioned 68-pounder carriage used in our Navy. The wheels run on a kind of railroad, mounted on two powerful balks of timber, which cross the turret diametrically, or nearly so. The forward pair of wheels are fitted with gearing, and the gun is run out, or rather forward, by a couple of men putting this in motion by suitable winch handles. The port is rather high, but only 16 in. wide, so that the muzzle of the gun does not at any time protrude, but is run right up, in firm contact with the inside of the turret wall. Aim is taken by causing the turret to revolve. An iron box, rectangular in section, and about 3 ft. long, contains the muzzle of the gun when run forward. This prevents noise, and preserves the men from

concussion. Between the sleepers on which the gun travels are bolted several longitudinal timbers, side by side. From the under part of the carriage a number of long plates of boiler iron depend, passing between the timbers. A powerful screw, worked by a hand-wheel at the side of the carriage, is arranged to compress these plates on the timbers to any extent deemed necessary. The friction produced is so great, that the recoil of the gun permits of exact regulation, being easily arrested in 4 ft. The guns are invariably of cast iron, reinforced with a single wrought-iron hoop.

All things considered, the introduction of ordnance of this size into our military or naval operations does not seem advisable, the Parrott 10-in. gun being superior in every respect. A 200-pounder shot, moving with a high initial velocity, is capable of smashing any iron plate at short range which can ever be fitted to a ship's side, and the weight of both the gun and the shot is fully as much as we can manage at sea under existing arrangements.

PERMANENT WAY.

Many thousands of pounds are annually wasted in the destruction of permanent way. We do not mean in legitimate wear and tear, but in that unnecessary deterioration which results from the employment of bad materials, the use of needlessly heavy rolling stock, and a faulty system of construction. Our railways date back some thirty years only; the first ten of these we may regard as having been devoted to experiment, from which certain rules were deduced to which our railway companies have adhered ever since, regarding apparently, further improvement as either unnecessary or unattainable. Economy has been sought for in the use of cheap rails, cheap sleepers, cheap chairs, &c., rather than in the adoption of those which, dearer at first, would, by their superior durability, effect a continuous annual saving in the outlay for maintenance. Indeed, this plan was carried to such an extent a very few years ago, that rails were little better than cast iron, being supplied at contract prices which effectually precluded their proper manufacture. Such rails have been known to break in two by being thrown from a waggon to the ground; while their duration, even when laid with great care, properly attended to, and nursed through their trials, rarely exceeded twelve months. This mode of proceeding was soon discovered to be simply ruinous; and a better class of rail, made almost without regard to expense, from good iron, properly piled and faggoted according to specification, is gradually finding its way into general use, with the best results. The first cost of a track laid with good bars is really very little greater than one laid with those of inferior quality, a much smaller quantity of iron sufficing per mile of road; a 45 lb. rail, if good, being fully equal in every respect to one of 60 lb., if bad.

A theoretically perfect track should be composed of rails absolutely hard on their wearing surfaces at least, incapable of deflection, and so laid that subsidence in any way, would be a mathematical impossibility. So long as we consider the permanent way alone without reference to the rolling stock, no difficulty presents itself to the carrying out of these conditions with an extreme degree of accuracy. Heavy rails, very deep, and steeled on the tables, keyed or bolted into large chairs, bedded on solid blocks of stone, carefully rammed and ballasted, would supply just such a track. But the conditions under which engines and vehicles can alone proceed with success, introduce the element of elasticity, which stone blocks and heavy rails do not supply. And in the reconciliation of these contending points lies the real difficulty of the question. If we retain the stone blocks; wood, felt, or india-rubber cushions must be introduced, either between the stone sleepers and the chairs, or between these last and the under surface of the rail. These cushions, in order to discharge their functions, must permit some play in the rail; and this once begun, cannot, by any arrangement yet adopted, be restrained within legitimate limits. Hence a very short time suffices to destroy the elasticity of the cushions. The spring of the system is then converted into jar and concussion, and the rapid destruction of the whole follows as a matter of course. Every plan which has been hitherto proposed for fixing rails to rigid sleepers has failed, and, in consequence, the employment of those which possess enough elasticity to prevent the necessity for separate springs, is all but universal. Timber has thus become as necessary for the formation of the substructure of a line of railroad, as iron for the superstructure; and the selection, preservation, and deposition of this rather perishable material becomes a matter of primary importance.

Considered in the abstract, however, wood is anything but a good substitute for stone, its first cost and rapid decay rendering it very objectionable. Whatever system is adopted, when flat-footed rails rest directly on timber sleepers, they sooner or later sink into them by crushing the fibres. The holding-down bolts, screwed up tightly at first, soon become too long in consequence; and the rail, no longer kept in firm contact with the wood, springs up and down on the passage of every train, acting to some extent as a hammer on the already weakened fibres, which absorb water like a sponge. The under surface is scarcely better off. Seldom or never packed up equally, hollows form between the wood and the ballast, which becomes hardened by the temporary pressure of the sleeper when deflected by superincumbent weight. Water collects in these hollows, and the wood rots from its effects. The crushing of the fibres is aggravated by the longitudinal system, to such an extent, that thin cross-boarding between the sleeper and the rail-foot has been used with considerable advantage; but this introduces an item of expense, and is, after all, but a sorry expedient. In the absence of chairs, it is better in all cases to place the sleepers across the track. A tolerably good line may be made in this way on good ballasting. The Great Southern and Western of Ireland is laid with 92 lb. rails, on this system, without fishes. The Chemin de Fer du Nord has several hundred miles laid with 74 lb. rails—carefully fished however—in the same way. Both these lines are worked by heavy engines—the Engerth Tank engines on the latter being, perhaps, the heaviest in the world, weighing 63 tons. Far more attention is paid to ballasting in France than here, the official report in 1857 showing that 17 per cent. of the whole cost of formation of the French railway had been for ballast. The cost of maintaining a cross-sleeper line laid with Ω rails will bear favourable comparison with almost any of the other systems; but it is seldom so easy on the rolling stock as it should be.

The double-headed rail, combined with cast-iron chairs, is so thoroughly habitual in Great Britain, that we need not dwell on the well-understood imperfections of a system with which our readers are familiar. Regard the matter as we will, we find the elastic sleeper arrangement defective, in that it entails the use of a destructible material, that it permits and indeed presupposes a considerable amount of deflection or yielding in the track without securing its proper elasticity, and that it is expensive both in first cost and maintenance. When rails sink under the tread of the wheels, they add materially to the expenditure of power required for the transport of a given load. In this, we find one reason why light locomotives do more work—especially on a weak road—proportionately, than those which are heavier; the deflection of the rail producing a resistance corresponding with the ascent of a continuous incline. All attempts at the use of a rigid substructure have, however, hitherto failed; and we are, to all appearance, as far from possessing anything like the theoretically perfect permanent way which we have described at the commencement of this article, as we were in the days of Stephenson the elder.

Now this is the case solely because we have for the last thirty years endeavoured to fit the rails to the carriages, instead of the carriages to the rails. We employ heavy vehicles, in the first instance, which so far injure the permanent way that it becomes unfit for those of lighter and perhaps weaker construction. Heavy carriages require heavy locomotives; and the permanent way is thus taxed to the utmost limit of endurance. Heavy rails are considered the only panaceæ, and expenses are increased without making the line really good. Starting with the conviction that elasticity between the wheel and the real support, the ballasting, is absolutely essential, it is not difficult to see that this may be as well attained by making the bearing of the wheel tyre elastic on the rim proper, as by making the bearing of the rail elastic on rigid supports; with this difference, that, whereas the latter is impossible from mechanical exigencies, the other is quite practicable. We must observe that no necessity exists for making the rail elastic, neither does there for making the tyre; it suffices that the rail rest on a spring cushion, and the same is true of the tyre. A case somewhat analogous may be found in the substitution of wheels for sledges. So long as the surfaces of rails are kept smooth and carefully lubricated, so long will a carriage mounted on runners travel along them with ease. These conditions are impossible of fulfilment, and the wheel becomes an expedient by which the friction is transferred from the surface of the rail, where smooth surfaces and efficient lubrication are not attainable, to the axle-box, where they are. Now, if the element of elasticity cannot be secured between the rail and its support, the stone sleeper, it remains to introduce it between the tyre and its support, the felloe of the wheel. The experiments conducted lately on the St. Helen's Railroad demonstrate the perfect practicability of such an arrangement; and it would be well worth while to try an engine suitably fitted, over a mile or so of road laid as rigidly as heavy rails and stone sleepers could secure. The outlay would not be much; and if successful—which we do not doubt—the experiment would be the harbinger of a revolution in railway practice which would lead, in the course of a few years, to a saving in the expenses of maintenance which would tell most favourably on dividends.

BOILER EXPLOSIONS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I have recently seen leading articles in the *Engineer* and the Mechanics' Magazine successively, upon what has been called the theory of boiler explosions, but more properly the theory of the violence of boiler explosions, in which the origination of the "pro-

jectile theory" (first so-called by myself in the *Encyclopædia Britannica*, and recently adopted under the same name in the *Engineer* of the 5th instant), is attributed in exactly the same proportions to Mr. Colburn and myself; and therefore, of course, any communication from me on the subject may apply equally to both articles. Mr. Colburn, it may be supposed, is the editor of the *Engineer*, and is also the writer of the articles that have appeared in that paper on the subject of the projectile theory; and I should naturally have addressed these remarks to that paper, but for the undignified personalities in which the editor indulges, and for the still more serious offence of suppressing legitimate correspondence.

I am, therefore, in hopes you will allow me to refer Mr. Colburn and the editor of the *Engineer* to my two letters on the projectile theory, which appeared in the MECHANICS' MAGAZINE of the 3rd and 10th May, 1861, and also to your leading article on the subject printed at the same time, on the 10th May. In those letters I endeavoured carefully and exactly to trace the course of the discussion in the *Engineer*, and showed that Mr. Colburn had not contributed in any material degree to the maturing of the theory, of which the first notion was originated by Mr. Harshman, and published by him in a pamphlet in 1855, and afterwards by letters in the *Engineer* in 1859.

To those two letters from me neither Mr. Colburn nor the *Engineer* has yet made any reply. In a note addressed to me, Mr. Colburn has, in fact, acknowledged that I have given him "*nearly all he knew of the action of steam by momentum.*"

I would also remind you, Mr. Editor, that you, in your leading article of May 10th, 1861, assign to me the credit of the prior claim to what is new in the projectile theory, and that you invited Mr. Colburn to show what he could fairly claim in the matter with reference to my correspondence. This he has not yet attempted.

In conclusion, I may remark that when one of two parties to a discussion is the editor of the paper in which it is attempted to be conducted, it is obvious that the editor has the advantage of position. He has his back to the sun without tossing for it. I have in my possession a mass of correspondence with Mr. Colburn on the subject of the projectile theory, and I have frequently proposed to him, as he appeared to consider the discussion and the settlement of the question to be of great importance, to talk over and arrange the matter quietly in the presence of one or two witnesses, who would take notes, and correct subsequent errors of memory, and so terminate this one-sided controversy. The proposal was at first accepted, and subsequently declined by him. The projectile theory was started by me in the course of a conversation I had with Mr. Colburn and his friend, Mr. Holley, of New York, in my office, on the subject of the explosion of the feedwater heater on board the "Great Eastern" shortly after it happened, when I put to them the direct question: How did it happen that the external casing was burst at the same instant that the chimney collapsed? There were two distinct simultaneous failures, of exactly opposite characters. Now the point requiring explanation was this—that an outer shell, subject only to internal pressure, should fail by bursting, as soon as a flue of nearly the same diameter collapsed, seeing that internal pressure is so much more easily resisted by cylindrical vessels than external or collapsing pressures. Neither Mr. Colburn nor Mr. Holley made any reply; and I suggested that the external shell was burst by the steam and water rebounding from the collapsed flue, the sudden enlargement of volume by the collapse of the flue giving rise to a sudden evolution of steam amongst the water, and a sudden dispersion and projection of the water against the inner surface of the casing by the force of the steam. In the number of the *Engineer* following the conversation referred to, Mr. Colburn attempted to explain the explosion in very contradictory terms. But I am reluctant to go over again the ground which I have already traversed in my letters of May, 1861, in the MECHANICS' MAGAZINE, and now briefly revert to that subject, to recall the attention of those who are sufficiently interested in tracing up the history of the projectile theory to the explanations I then made. I submit that the publication of matter in a journal, though one mode of establishing priority of claim, is not the only mode; and I propose to refer the whole question to a competent judge of evidence—say Queen's Counsel, and to accept his decision.—Your obedient servant,

D. K. CLARK.

11, Adam-street, Adelphi, London.
September 22, 1863.

[We are pleased to find that Mr. Clark does not substantially contradict any statement we have lately made with regard to his claim to the origination of the received theory of explosions. Mr. Colburn was the first to *publish* his views of the matter, and it is quite beyond our province to pronounce on their originality. We cannot, in our editorial capacity, recognize any private conversation or unpublished letters as evidence bearing on the case. Mr. Clark may probably have communicated his ideas to many others as well as to Mr. Colburn; but with that we have nothing to do, as we can only interfere in the question of priority of publication. We must beg to differ from Mr. Clark in our estimate of the value of Harshman's theory, which really bears very little relation to the one under consideration. And we have already expressed an opinion on the projectile theory, which shows that we are not prepared to fully endorse it in its present form. —ED. M. M.]

GREEK FIRE.

JUDGING from the outcry which has been raised against General Gilmore by certain partizans of the "so-called Confederate States" for the use of shells which contained "Greek fire," one would think that nothing had been done in this country to patent and perfect such instruments of destruction. It so happens, however, that the Americans are only following our teachings in this particular. Readers of the MECHANICS' MAGAZINE have, for years past, been made familiar with inventions having for their object instantaneous and unmitigated destruction. We do not know of what "Greek fire" is composed, neither do we know the origin of the phraseology. From certain obscure documents of the Eastern Empire, we suppose the designation "Greek fire" means either a rocket, or a liquid combustible material, composition unknown, which, being projected through tubes or in jars, set fire to combustible substances. During the Russian war, Capt. Disney exhibited at a public meeting certain glass shells, which, when thrown against a hard substance, burst, and, in a few seconds, set fire to all combustible material with which they came in contact. Before this, Capt. Norton had suggested a small-arm incendiary rifle projectile. At one time, scarcely a month passed without a little letter appearing in our columns from the last-named gentleman describing some "Beelzebub" machine, which had for its object rapid and certain destruction in war. During the Crimean war, Mr. J. Macintosh called the attention of the Government to the extraordinary efficacy of certain projectiles, which he called "liquid-fire" shells, and to the application of other fiery materials in warfare. A special committee was appointed to inquire into the whole question, and a series of experiments was tried at Shoeburyness, by which inflammable materials were consumed at a distance of 800 yards. In August, 1855, Mr. Macintosh patented another invention. The following passage occurs in the specification:—

"I fill diaphragm shells with coal-tar naphtha, mixed with phosphorous and bisulphuret of carbon, having a bursting charge sufficient to open the shells. When fired, the bursting of these shells scatters the contents in all directions, and the shower of inflammable material, falling among cavalry and troops, ignites spontaneously, causing their immediate disorganization. Fired into shipping, these shells, bursting on deck or below, scatter the inflammable material in all directions, and the spontaneous combustion which arises causes inevitable and irremediable injuries and destruction to the crew, who are unable to escape except by dropping overboard, and the vessel itself is speedily consumed, aid from the crew having been rendered impossible as just described. Fired into harbours, dockyards, or towns, the result is alike destructive and decisive."

The use of such shells may be denounced as inhuman and contrary to the usages of civilized warfare. Is not all warfare uncivilized and barbarous? No doubt the invention of gunpowder and its application to warfare was at one time considered inhuman, as the application of liquid fire is considered by some now. If, however, men will go to war, the more deadly and destructive the modes of warfare are made the better. In the earlier ages victory was generally given to the army which could march the quickest and endure the most. Then, *brute* force was the arbiter in quarrels; now, *science* has superseded brute force. Victory waits, in these days, on intelligence and invention, and not on strength of muscle. Though the "so-called Confederates," as Earl Russell terms them, have exhibited a vast amount of bravery and endurance, they are not as yet a match for the Federals in the "*art* of war." Such a result, in fact, might have been expected. The Southern States have produced a host of orators and able statesmen; the Northern States have been most prolific in invention and scientific discovery. In fact, almost everything done in America in scientific research and improvement has come from the North. The Northerners are masters of the situation, not only on account of their great resources, their superior numbers, and their better cause, but because they are enabled to evoke more assistance from science than their enemies. We have consumed years and millions sterling in endeavours to perfect a system of Armstrong artillery, and are not advanced, according to the report of the last Commission of Inquiry, beyond the old 68-pounder; whereas the Federals, in a few months, have literally done wonders. English artillerists are startled at the results which have been achieved. The Federals have thrown explosive projectiles 15 in. in diameter, seven miles. The south should have calculated on the superior scientific facilities of the North before they submitted their case to the uncertain and bloody arbitrament of battle; and English journalists and caricaturists, now they see the matchless energies and scientific resources of the North, will perhaps moderate their temper and deal less fluently in insulting epithets. They will, at all events, no longer repeat the silly expression of an English clergyman, that Yankeys are as much inferior to Englishmen as monkeys are to men. Peradventure, even reckless shipbuilders, who, in their greed

of gain, have brought, as the *Times* said on Wednesday last, this country "to the verge of war," will, at the eleventh hour, and in obedience to necessity, listen to the voice of conscience which a great tribune a short time since so eloquently evoked.

Though the North has beaten the South in construction of guns, the South has mastered the North in the manufacture of torpedoes. Our last number contained a description of these "inventions of the devil," as they were called, which have been so liberally distributed in the Missisippi river and Charleston harbour. One morning a torpedo exploded near the "Pawnee," and blew her launch to fragments; a few moments after another exploded, and then another. These machines are constructed with remarkable ingenuity. As they float down the tide the anchor-chain of the vessel which is to be destroyed, catches the ropes which attach the torpedoes; the torpedoes then swing round and strike the sides of the vessel. It so happens, however, that these machines are no respector of persons. When floating on the tide, they are as ready to sink the enemy's gunboat as to shatter to fragments vessels laden with friendly assistance which may have run the blockade.

Captain Maury, who is by far the most scientific man the Southern States have produced, has just written a long letter to the *Times*, soliciting British sympathy on the ground of the inhumanities committed by Northern armies. He omitted to state that Southerners commenced, through Morgan and others, destructive raids on inoffensive districts; and that the "Alabama" and "Florida" pitilessly destroy what they cannot appropriate on the high seas. He omitted to state that these vessels burn the ships they capture at night-time so that they may attract other ships to the scene of conflagration, to meet a similar doom. We would advise Captain Maury to read Emerson's Essay on "Compensation." Whatsoever men sow, that shall they reap. The Southerners have sown the wind, and are deservedly reaping the whirlwind.

J. P. E.

THE "BARON OSY" STEAMER.

HAVING, in bygone times, enjoyed several trips on this fine steamer, our interest in the vessel led us to pay her a visit of inspection, during her present unfortunate plight. It will probably be known to most of our readers that the "Baron Osy" steamer (built by Mr. Scott Russell at Millwall) was lately sunk in the river—while coming up Limehouse Reach on her way from Antwerp to St. Katherine's Wharf—nearly opposite Mill Stairs. She is supposed to have struck on some lost anchor or mooring ring. Whatever the thing was, it stove in her bottom, and dragged a rent more than 9 ft. long. As she was making water very fast, her stem was turned to the Surrey shore; her bow sank with the rise of the tide, but being provided with a water-tight bulkhead, her after-part only sank in about 15 hours. She had nearly 100 passengers, and a cargo of 9 boxes of bullion underneath a cwt. of baskets of walnuts, which had to be hastily thrown up from the after-hold in order to save the gold.

The work of raising the vessel—safely accomplished on Saturday fornight—presented a striking scene. At low water, chains, pinned to lighters, were passed under her bottom; ropes being laid to haul the vessel to shore as she lifted. Two powerful steam pumps were placed on board, one over the after, and the other over the fore hatch; in the first case, a 9-in. delivery centrifugal pump (by Clinton and Owens), driven by an 8-horse portable engine; in the second, a pair of the Norton V-pumps, now attracting so much attention from the admirable simplicity and ingenuity of their construction.

The leak is in the fore part of the vessel, separated from the after part by a water-tight bulkhead, and accordingly Norton's pumps were placed over the fore hatchway—the post of hard work and of honour. These pumps drove quite a cataract of water over the side of the vessel. They reduced the depth of water at the rate of 2 in. per minute, and in less than 35 minutes 5 ft. of water were pumped out of an area of about 51 ft. by 22 ft. The vessel then rose on the early flood, and was safely got over to the Surrey side of the river.

The performances of these pumps so much attracted our notice that we have ascertained their exact dimensions and performances for the benefit of our readers. In our number for last April, page 308, will be found an illustrated account of this remarkable description of pump, so that we need not here enlarge upon its mode of construction. The particular pumps in question, were fitted with 8-inch V's, 12-inch stroke, and a 10-inch suction pipe. They were driven by a 6-horse power engine, making 70 revolutions per minute. The boiler worked with 35 lbs. pressure of steam, consuming 84 lbs. of coal per hour. The water was raised at the rate of 65,000 gallons per hour, weighing, of course, 260 tons. It must be also remembered that the river was pouring in at a leak from 9 ft. to 10 ft. long, and in some parts nearly 3 in. wide. Altogether, the owners of this new pump may well be proud of its last feat.

We understand that the "Baron Osy" will have to be docked in order to repair her great damages; and after being purified of the odoriferous Thames mud by means of fire-engines, this fine vessel will, no doubt, be again placed on the London and Antwerp line.

THE "PRINCE CONSORT."

THE "Prince Consort" was laid down at Pembroke as a line-of-battle ship on the same lines as the "Gibraltar"; but was afterwards cut in two, lengthened 23 ft., and, like the "Ocean," reduced to a two-decker. She was first called the "Triumph," but this name was altered to the "Prince Consort." Her launch took place in June, 1862. The dimensions are:—Length over all, 277 ft.; length between perpendiculars, 273ft.; keel for tonnage, 232ft. 3¾in.; breadth extreme, 58 ft. 5 in.; ditto for tonnage, 57 ft. 2 in.; ditto moulded, 56 ft 4 in.; depth of hold, 19 ft. 10 in.; tonnage, 4,045 26-94 tons; ditto Board of Trade 3,521·34 tons; tonnage of engine-room, 1,913·74 tons; ditto register, 1,907·6 tons; displacement when light, 2,924 tons; ditto estimated when loaded 6,328 tons; estimated draught when loaded, 23 ft. 7 in. forward, 25 ft. 2 in. aft. Her draught when launched, was 12 ft. 11 in. forward, and 16 ft. 10 in. aft.; mean draught, 14 ft. 10½ in. It is intended on her trial trip, which will shortly take place, to make her draw 23 ft. 8 in. forward, and 25 ft. 8 in. aft. Her iron masts are stepped, and the guns are on board; there will also be six months' stores in her; the remainder will be made up with iron ballast. The heel of the main mast is forked to admit the propeller shaft; the mast is 115 ft. 6 in. long; foremast, 109 ft. 6 in.; mizen, 82 ft. 8 in., and bowsprit, 41 ft. 6 in., all of iron. The armament on the main deck is 24 guns for 8-in. solid shot, each weighing 25 cwt., with four Armstrongs, 110-pounders, each weighing 84 cwt. forward, and the like number aft.; on the upper deck two Armstrongs forward and one aft, 45 in all. The engines collectively of 1,000-horse power (nominal) are from the manufactory of Messrs. Maudslay, Sons, and Field, and are seated 15 ft. before the mainmast; they are termed "horizontal double piston rod." The horizontal double action air-pump is worked direct from the engine. Each of the engines is fitted with box slides; worked by double eccentric and link motion. The air-pump valves are of india rubber, with metallic valves to discharge through the sides of the ship. The air-pumps are 29 in. in diameter, and have a 4 ft. stroke. The inside diameter of the steam cylinders is 92 in.; they are steam jacketed. The diameter of the main steam pipes is 23 in. There are also in the engine-room two small auxiliary engines of 12 in. diameter. Each of these is fitted with a pump for filling boilers from the sea, together they are capable of supplying the requisite amount of water when the main engines are working full boiler power. She has in addition a double 7 in. pump, which can be worked by hand or steam, capable of supplying a sufficient quantity of water for working half-boiler power, and arranged so as to pump on deck or overboard and to draw water from the bilges or the sea. The "Prince Consort" has two stoke-holes—the one before the engine-room has four boilers, with five furnaces in each; the one, abaft four boilers, with furnaces in each. The eight boilers contain 3,840 tubes, each of which is 6 ft. long by 2½ in, outer diameter, and 2¼ inner diameter. By the forward boilers the power of 600 horses (nominal) can be obtained, and by the other 400 horses, calculated at 7 lb. effective pressure per square inch. The fore chimney is 8 ft. 3 in. diameter, the after 6 ft. 6 in. Both stoke-holes are well ventilated; but the presence of the screw shaft casing, shoulder high, in the after stoke-hole, is very inconvenient. The after stoke-hole is, however, a little wider than the fore stoke-hole. The length of the propeller shaft inboard is 98 ft. 3 in., weight 17 tons, diameter 18 in. forward, and 20 in. aft. The gun-metal screw-propeller is four-bladed; it weighs about 15½ tons, and overhangs, or, rather, has no outer bearing. The diameter is 21 ft., and the pitch on Maudslay's principle, can be altered from 20 ft. to 25 ft. The stern bracket is surfaced up, and the boss of the screw is surfaced also; the machinery is arranged so that the screw-shaft can be carried forward to close the opening entirely when the two surfaces meet, and thus the sudden influx of the sea can be prevented in case of an accident similar to that of the "Royal Albert" in 1856, when the water rose to her ash-pans, and her commander was obliged to run her on a sand bank in the Island of Teo, in the Mediterranean. The "Prince Consort's" screw shaft is fitted with a disconnecting clutch and friction brake, by which, when the ship is under canvas only, the screw will be allowed to revolve freely in the water. The brake can be used when necessary to stop the screw, and reconnect it with the engines for the purpose of resorting to steam. In the fore stoke-hole there is a spare blade for use in case of accident; like the others, its flange is perforated with slotted holes for the reception of the screws which fasten it to the boss. The blades are twisted slightly, and become much thinned towards the outer ends. The engines and machinery weigh 750 tons; the cost is about £50,500, and the manufacturer obtains in addition £1 per horse power (£1,000) for placing them on board. To aid the ventilation, holes have been peforated in the masts above and below, and the coal shoots have hollow-work deck covers, which admit both air and light. Cowl-head ventilators can be substituted. On the suggestion of Mr. Sampson, her engineer, her iron flaps in the air casings which inclose her smoke chimneys below give place to glass doors, by which light as well as air is admitted to the 'tween decks. At each side of the upper deck of the "Prince Consort," amidships, there is a round tower, 7 ft. high and about 5 ft. diameter, constructed of wood 12 in. thick, which will be plated with iron 4 in. thick. The shipwrights' work is complete, and, excepting the last coat, which will not be applied until she is further advanced, most of the painters' work is finished. The "Prince Consort," though not built for, can be used as a ram; she is classed with the "Caledonia," built at Woolwich; the "Ocean," at Plymouth; the "Royal Oak," at Chatham; and the "Royal Alfred," at Portsmouth. The two last have engines of 800-horse power, the other three of 1,000-horse. All are iron-plated. The number of plates on the "Prince Consort" is 259, and weight 873 tons; bolts and nuts, 26 tons; those on the "Ocean" will be 275, weighing 935 tons; the odd plates go round the stern. The plates on the "Prince Consort" are rolled; those on the "Royal Oak" are hammered. Where the displacement of the "Prince Consort" is 6,328 tons, that of the "Royal Oak" is over 7,000 tons.—*Times*.

IMPREGNABLE SHIPS OF WAR.

MR. W. W. WARREN proposes to construct ships-of-war which shall be impregnable, and capable of discharging their guns under the water level.

"I prefer," writes Mr. Warren, "constructing the centre portion of the vessel of rolled wrought-iron double-flanged vertical ribs, from 12 to 18 in. wide, and from 2 to 4 in. thick, firmly rivetted and bolted together, or of angle or T iron, solidity and stiffness being the great object, on which are placed the various layers of malleable metals, taking care to stop all chemical or galvanic action, by means of bituminous composition mixed with hair; and were it not for the cost I would prefer using the finest copper-plating only over the iron, so as to act on the principle of a gradual tenacity of resistance, thereby easing and stopping the momentum, and distributing the shock, and thus prepare the iron-plating to firmly resist, without splitting or destroying the plate; or

the roof-deck and sides of centre position of battery can be protected with oak, or other wood, compressed in short lengths, and confined, the cross-grain of wood being opposed to the action of fire.

"The fore-and-aft and other portions of the battery, not requiring armour-plating, to be constructed with wrought-iron ribs, with an outer skin only, and to be filled in with hexangular or honeycomb compartments of the maximum size of shot, made in short lengths, and firmly rivetted and bolted together, so that, in case of water entering, it is confined to the track of the ball, after which it can be easily stopped, and by an arrangement of valves can be pumped out. To wooden-ships, if armour-plated at all, I would apply the plating inside thereof, thereby making the external wood act as a buffer or padding. The port-hole for discharging the submarine gun must be provided with water-tight metal flap, instantly closing after the recoil of gun, the barrel of gun acting in a stuffing-box, with a water-tight box adjoining for adjusting cap to muzzle. The port-hole to be provided with a slide valve, as an extra precaution. The cap can be made of any reasonable length, so as to displace a greater volume of water, and, if necessary, a telescope tube can be adjusted to port-hole and elongated by a rack-and-pinion movement, or an ordinary muzzle-loading gun can be used, by simply applying a waterproof flexible hose, of sufficient length to allow of the recoil of gun, and having moveable collars attached to muzzle and port-hole. The hexangular cellular system is not only capable of displacing and carrying any weight of armour-plating, but is admirably adapted for the reconstruction of existing wooden ships, thereby making them seaworthy and unsinkable at a comparatively small expense, without the necessity of armour-plating at all, simply by placing the hatchways to lower deck; and is likewise admirably adapted for the construction of life-boats, floating docks, &c., on account of it reducing the maximum amount of external injury to the minimum amount of internal damage."

Mr. Warren's principle of construction seems to be good; and, in the absence of experiment, it would be premature to pronounce an opinion on the probable success with which guns could be discharged under water.

ON SPECTRAL ANALYSIS.*

By Prof. PLUCKER.

IT is generally admitted now, that every gaseous body rendered luminous by heat or electricity sends out a peculiar light, which, if examined by the prism, gives a well-defined and characteristic spectrum. By such a spectrum, by any one of its brilliant lines whose position has been measured, you may recognize the examined gas. This way of proceeding constitutes what is called spectral analysis, to which we owe, until this day, the discovery of three new elementary bodies. In order to give to spectral analysis a true and certain basis, you want the spectrum of each elementary substance. Most recently, some eminent philosophers, in examining such spectra, met with unexpected difficulties, and doubts arose in their minds against the new doctrine. These doubts are unfounded. The fact is, that the molecular constitution of gases is much more complicated than it has been generally admitted till now. The spectra, therefore, always indicating the molecular constitution of gases, ought to be more complicated also than it was thought at first. By these considerations, a new importance, a rather physical one, is given to spectral analysis. You may recognize, by the spectrum of a gas, not only the chemical nature of the gas, but you may also obtain indications of its more intimate molecular structure—quite a new branch of science. Allow me now to select out of the results already obtained two instances only. Let me try to give what I may call the history of the spectra of two elementary bodies—of sulphur and nitrogen. In order to analyze by the prism the beautiful light produced by the electric current, if it pass through a rarified gas, I gave to the tube in which the gas is included such a form that its middle part was capillary. Thus I got within this part of the tube a brilliant film of light, extremely fitted to be examined by the prism. The date of my first Paper on this subject is the 12th of March, 1858. After having provided myself with apparatus more suited to my purposes, I asked, about a year ago, my friend, Prof. Hittorf, of Münster, to join me in taking up my former researches. The very first results we obtained in operating on gases of a greater density opened to us an immense field of new investigation. We found that the very same elementary substance may have two, even three, absolutely different spectra, which only depend on temperature. In our experiments we made use of Ruhmkorff's induction coil, whose discharge was sent through our spectral tubes. In order to increase at other times the heating power of the discharge, we made use of a Leyden jar. Now, let us suppose a spectral tube, most highly exhausted by Geissler's mercury pump, contains a very small quantity of sulphur. The discharge of the coil will not pass through the tube if it do not meet with ponderable matter, either taken from the surface of the glass, or, if the discharge be very strong, by the chemical decomposition of the glass. In heating slowly the tube by means of a lamp, in order to transform a part of the sulphur into vapour, all accidental spectrum, if there be one, will disappear, and you will get a pure and beautiful spectrum of sulphur. I supposed the Leyden jar not to have been interposed. If you now interpose it, the spectrum just spoken of will suddenly be replaced by a quite different one. We were generally led to distinguish two quite different classes of spectra. Spectra of the first class consist in a certain number of bands, variously shadowed by dark traversal lines. Spectra of the second class consist in a great number of most brilliant lines on a dark ground. Accordingly, sulphur has one spectrum of the first class and another one of the second class. You may as often as you like obtain each of these two spectra. In operating on a spectral tube, containing nitrogen at a tension of about 50 millimètres, you will, without the Leyden jar, get a most beautiful spectrum of the first class. After interposing the jar, a splendid spectrum of the second class will be seen. But here the case is more complicated yet. The above-mentioned spectrum of the first class is not a simple one, but it is produced by the superposition of two spectra of the same class. Ignited nitrogen, at the lowest temperature, has a most beautiful colour of gold. When its temperature rises, its colour suddenly changes into blue. In the first case, the corresponding spectrum is formed by the less refracted bands extended towards the violet part; in the second case, it is formed by the more refracted band of the painting extended towards the red. Nitrogen, therefore, has two spectra of the first class, and one spectrum of the second class. The final conclusion, therefore, is that sulphur has two, nitrogen three, different allotropic states. It may appear very strange that a gaseous body may have different allotropic states—*i.e.*, different states of molecular equilibrium. It may not appear, perhaps, more strange that a substance, hitherto supposed to be an elementary one, may really be decomposed at an extremely high temperature. From spectral analysis there cannot be taken any objection that sulphur and nitrogen may be decomposed. Chloride of zinc (or cadmium), for instance, exhibits two different spectra. If heated like sulphur, and then ignited by the discharge of Ruhmkorff's coil, you will get a beautiful spectrum either of chlorine or of the metal, if either the Leyden jar be not interposed or be interposed. There is, in this case, a dissociation of the elements of the composed body in the highest temperature, and re-composition again at a lower temperature. You may consider the dissociation as an allotropic state, and, therefore, I may make use of this term as long as the decomposition be not proved by the separated elements.

* Read before the last meeting of the British Association.

ON THE SYSTEM OF FORECASTING THE WEATHER PURSUED IN HOLLAND.*

By Dr. BUYS BALLOT.

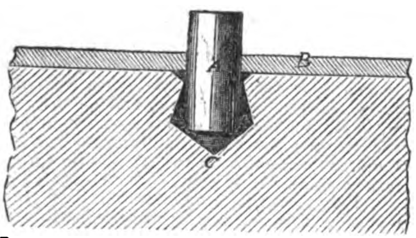
THE author said:—"I shall not abuse your indulgence, which I earnestly implore. I shall very shortly explain (1.) what are the rules about foretelling weather in Holland, given before a similar system was introduced in England; (2.) how they behaved themselves; and (3.) what is to be done now; and I will very abundantly answer to any question or remark if they be made, for in that case I am justified in trespassing on your time.—(1.) Under our plan, where observations are taken in Holland, there are four principal places: Helder indicated by H, Groningen indicated by G, Flushing indicated by V, and Maestricht indicated by M, on the indications of which I base my forecasts, and in the first place on the barometer readings. For every day of the year and for every hour of the day I have very carefully determined the height of the barometer in the place of observation at that height above the sea, where it is suspended. This is a cardinal point not sufficiently observed in England, and not at all in France. The difference of an observed pressure from that calculated on I call the departure of the pressure—positive when the pressure is greater, negative when it is less. Those departures, besides the observations of the other instruments, are communicated from post to post. The rule is now very simple. If the departures are greater (more positive) in the southern places than in the northern, greater at M or V than at G or H, the wind will have a W. in its name; when the departures are greater in the northern places the wind will have an E. in its name. More accurately you may say, The wind will be nearly at right angles with the direction of the greatest difference of pressures. When you place yourself in the direction of the wind (or in the direction of the electric current) you will have at your left the least atmospheric pressure (or the north pole of the magnet). When the difference of pressure of the southern places above the northern is not above four millimètres there will be no wind of a force above 30 lb. on the square mètre. Moreover, the greatest amount of rain will fall when the departures are negative; and at the places where the departures are most negative, there also the force of the wind will be generally stronger. Moreover, there will be no thunder if the barometric pressure is not less than two millimètres above the average height, and when at the same time the difference of the departures of temperature is considerable. Those rules, and especially the first two, were laid down by me, in 1857, in the *Comptes Rendus*, and on the 1st of June, 1860, the first telegraphic warning by order of the Department of the Interior was given in Holland. It was unfortunate that those telegraphic warnings were not introduced four days sooner, for in that case the first communication would have been a first warning against the fearful storm of May 28, 1860, called the Finster-storm. All of you know how amply Admiral FitzRoy has arranged the telegraphic warnings all over England.—(2.) Those rules used in Holland have behaved themselves very well, as is laid down in the translation of a Paper of Mr. Klein, captain of a merchant ship, whereto I have added my observations and signals compared with the signals of Admiral FitzRoy in table A, p. 25. My own Paper dates from June 1, 1860, and is extracted by Mr. Klein as you may see, but I preferred that the less complete and precise Paper of a practical man be translated, because I thought that the seamen would put more reliance on it. From the tables added to that translation it appears that I have warned from my four stations, just as Admiral FtizRoy has done from his twenty. It must, however, be recorded that, besides those four stations, there are also some stations—Paris, Havre, Brest—in France, and some in England—Hartlepool, Yarmouth, Portsmouth, Plymouth—that send me their observations. Generally they arrive too late, and, therefore, they throw but very little light on the forecasting, principally while the barometers are not so well known. So much for the strength, now for the direction. The direction is in the first twenty-four hours after the observations, three times of the four such as indicated, and the second twenty-four hours and the third twenty-four hours still two times of the three such as indicated (see table B, p. 29), and, moreover, no storm has occurred in those six years when not before the the difference of the southern departures above northern has been four millimètres.—To come to the third point. (3.) What is to be done? The normal heights of barometric pressure, or better of the barometers, which are read, must be conscientiously taken, the observation must be made at more points once a day, and mutually communicated, and at days when there are greatly different departures, that is to say, of three millimètres, or when there is a change of inclination, there must be sent a message at noon or in the evening of the same day. In all cases, not only the pressure in the morning, but likewise at night, should be given. A critical indication is, when the previous day the northern stations had greater departures and the following day the southern had greater departures, even when the difference in the latter case was small. There is caution to be had when the difference of the departures is four millimètres. But I may not trespass on your time and kindness in expressing wishes only, it may be sufficient to have communicated the general rule."

* Read before the last meeting of the British Association.

HASELTINE'S IMPROVEMENTS IN UNITING METALLIC SURFACES.

The following improvements in fixing sheathing on ships has been patented by Mr. G. Haseltine, of Southampton-buildings, Chancery-lane:—

This invention chiefly consists in securely joining thin metallic sheathing to iron plates by means of simple rivets, cut in suitable lengths from copper or other wire, and, for preventing galvanic action between the sheathing and plates, by the introduction of india rubber or gutta percha between the sheathing and said plates, either in the form of thin sheets, or by one or more coats of paint or wash, composed of said material, or of other substances possessing similar properties. These rivets, made to completely fill the perforations in the sheathing, pass into interiorly enlarged cavities formed for their reception in the metal plates. After their insertion into these cavities, the rivets are secured by blows struck upon the outer ends, which cause them to spread sufficiently at their inner ends to completely fill the cavities in the plates. A countersink is made in the plate at the mouth of each cavity, into which the edges of the sheathing is forced by the blows, which form at the same time the head of the rivet. By this means the sheathing is securely fastened to the plates, the heads forming with the sheathing a smooth and uniform exterior surface, as shown in the accompanying drawing.



In applying the above mode of uniting metallic surfaces to vessels plated with iron armour in which the joints between the plates are covered by strips of iron, the patentee inserts between the iron strips wooden strips of equal thickness to secure a uniform exterior surface to the hull of the vessel. These wooden strips render the process of sheathing the hull more convenient and less expensive.

LEBLANC'S WATER GAUGE,

Patented by Desire François Leblanc, 3, Percy-street, Bedford-square.

We feel much pleasure in laying before our readers particulars of a glass water gauge which is extensively used in France, and deserves general introduction here. It is not only stronger and safer perhaps than any other gauge which shows the water level through a transparent medium, but it possesses the great advantage of always denoting the presence or absence of water from the glass tube. The ordinary gauge may be quite full yet appear empty, or quite empty and appear full. It is impossible that such a result can take place with Leblanc's gauge, for reasons which the specification will best explain:—

Let us consider a rather thick-sided glass tube half-filled with water, we shall readily note the wide difference in refraction which exists between the full portion of it and the empty part thereof; and now let there be a screen provided with a circular hole of about two-thirds of the outside diameter of this tube placed behind that portion of it which is full of water, and this circular hole will appear in the form of an ellipse, having its great or transverse axis perpendicular to the axis of the tube, whilst on the same screen being removed behind the empty portion of the tube the ellipse assumes a rather lengthened form, having then its great or transverse axis parallel to that of the tube.

It follows from this, first, that such a screen may be used to inform us—when no solution of continuity appears in the tube—whether this is quite empty or quite full.

And secondly, that, however darkened its sides may be, unless they are altogether opaque, it will always be possible for any one to ascertain with its aid the presence or the absence of the liquid inside.

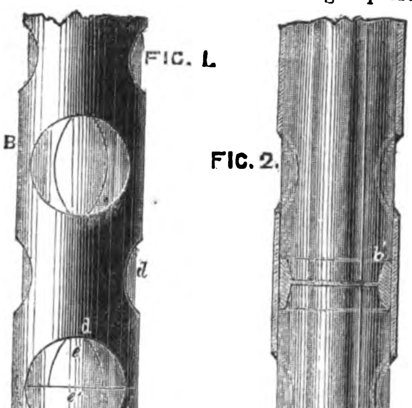
A metallic tube pierced from end to end with circular holes opposite to each other on two or three alternate diameters, and encasing the glass tube, may therefore become at once both a protection against breakages and their effects, and a means of more distinctly showing the height of the liquid inside.

Such is the nature and object of the said invention for "A Dioptical Metallic, Level Indicator or Liquid Gauge," but essentially consisting in the application of the combined dioptical properties of glass and water to the construction of a liquid gauge that should possess such requisites to clearness of indication and security of service as have never been as yet attained, it is susceptible of any form; for example, a glass tube consisting of several short ones may be advantageously substituted for that of one piece, and lenses for either of them.

Again, a casing made of any flexible mâtter, as vulcanized or hardened india rubber, or simply sheets of paper or cloth, impregnated with siccative greasy substances, rolled several times and stuck on the glass tube, may also be used instead of the metallic casing.

Being given a quadrangular opaque tube, the sides of which are pierced with two circular holes opposite to each other; if you fix in each of them a plano-concave lens, whose concavity faces the axis of the tube, and whose focus lies a little behind the opposite side; the hole that faces the lens which is looked at will appear greatly reduced in diameter, the tube being empty; whilst, on the same being filled with water, the index of refraction of this being pretty nearly the same as that of glass, the concavity of the lens is found to be almost annulled by the convexity of the water, and the opposite hole reappears with its nearly full diameter. The crown glass gives the maximum of differential effect.

Figs. 1 and 2 of the annexed drawings represent



a glass tube enveloped in a metallic casing pierced with circular holes opposite to each other. The metallic casing may be simply a non-adhesive case surrounding the glass tube, but it is better to have it fixed thereon, by means of a mastic or cement, such as that of ceruse and minium, oxychloride of zinc, and such like.

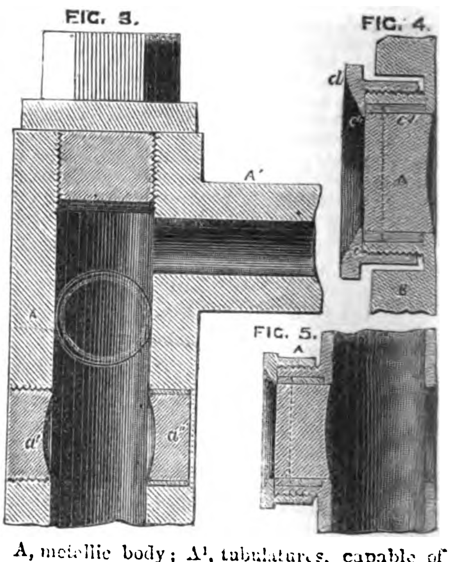
A is the glass tube; B, the metallic casing; c, the mastic; d, the holes of the casing; e, the outline and direction of the ellipse, as seen in the empty part of the tube; e^1, the same as seen in the part occupied by the liquid.

Indicators of unlimited length and best fitted to resist expansion will be obtained by using short glass tubes joined end to end. For this purpose it is necessary that each joint should correspond with the middle of a space without holes, so long as the sealing should prevent leakage.

The mastic of ceruse and minium, by reason of its solidifying slowly in a cold place, appears to be the most suitable one to employ. The complete solidification is obtained by its being exposed for two or three hours to a temperature of from 200 deg. to 250 deg. centigrade. All mastics that solidify slowly in a cold place and quickly in a hot one may likewise be advantageously used. Coloured mastics, and above all those coloured with black, render more distinct the perception of the optical phenomenon.

The glass tube extends a little beyond the metallic casing, in order to obtain a hermetical joint, in case the sealing of its extremities to its casing should not be quite water-tight, and thus to prevent acids and other agents from attacking the metal or the mastic. This disposition, however, is not indispensable, and in most cases the glass tube will be level with its casing.

Fig. 3 represents the section of an indicator, provided with lenses.



A, metallic body; A^1, tubulatures, capable of receiving cocks; a, a^1, a^{11}, plano-concave lenses. There are many means of fixing the lenses in the holes; they may be screwed with an oily mastic, as in a^1, or simply sealed with a mastic, specially that of cast iron in brimmed holes, as in a^{11}, or only hot fixed by means of a sufficiently fusible enamel, provided that the glass made use of be of a dilatation pretty nearly the same as that of the metal employed, which should be little dilatable itself, such as cast iron, iron, steel. I do not mention platinum because of its high price.

Lenses may also be placed on thinner tubes by means of tubulatures, A, fig. 4, into which they are fixed, either with a mastic or with india rubber, by means of a screw cap. They may likewise be sealed with an enamel into very thin tubulatures which will attenuate the effects of expansion. By enamelling the cast iron, iron, and steel tubes, they will thoroughly be kept from oxydation.

Fig. 5 represents an enlarged view of a mode of fixing the lenses in the tubulatures.

A, lens; B, side of the tube; c, externally screwed tubulature; c^1, matter of the joint, which matter may be, according to the case, either a ring of vulcanized india rubber, or amianth, impregnated with mastic, or simply oiled hemp for both low and mean pressures; c^{11}, metallic ring that compresses the joint; d, screwed cap, screwing on the metallic ring.

AMERICAN MEN OF WAR.

The "Dictator"—the large ocean "Monitor" at the Delamater Ironworks—is rapidly approaching a finished state. The *Scientific American* states that she will be launched some time during the autumn A strong force of men is at work, although they are not visible in masses, the vessel being so large that they are lost in her. The ship carpenters are busily engaged in putting on the timber backing of the side armour; it consists of oak logs, about 12 in. square, laid in sections; in all about 5 ft., as we are informed; outside of this there will be 10½ in. of iron, also put on in sections. The engines and turret machinery are well along, and progressing favourably.

The character of the engines is the same as those in all the "Monitors," with the exception that the cylinders and all reciprocating parts are vertical; a desirable feature in engines of this size—namely cylinders 100 in. in diameter by 4 ft. stroke of piston.

In the state they now are, no adequate description can be given of the general arrangement, except to say that the cylinders are set amidship, and the air-pumps aft of them; that the steam chests are on the outboard side of the cylinders, where the bonnets can be readily removed, and that expansion valves are provided.

One of the cylinders fell down a distance of 5 ft., while suspended from the shears, which ruined it so that it had to be replaced by one cast for the "Puritan," consort, now building, at Greenpoint, by Thomas F. Rowland. The cause of the disaster was the breaking of the guy ropes which stayed the shears; fortunately, no lives were lost. The company incur a heavy expense by this unavoidable accident; the completion of the ship will not be delayed by the casualty. The overhang of the armour shelves on the sides af the "Dictator," is much less than in the "Monitors," being only some 2ft.; while the projection forward and aft is also less than the same parts in the smaller batteries; we notice that the armour shelves are strengthened by the addition of iron-plate sponsons.

The "Dictator" has an immense screw-propeller, of 21 ft. 6 in. diameter, and 32 ft. pitch; there is no outboard bearing for the shaft. The boilers are six in number, three on each side, and are of the return tubular pattern. The ship herself is 320 ft. in length 50 ft. in width, and 20 ft. deep; there will be two turrets, whose walls are 15 in. thick; outside diameter to us unknown.

The "Dunderberg"—a wooden vessel, immensely thick and strong in the hull—is assuming shape and form as rapidly as human hands can do the work. Mr. W. H. Webb is her builder; and the singular appearance of the hull, as well as the monstrous projecting ram forward, attracts much attention, and provokes criticism from every one, whether competent to pass judgment or not. The whole ship is solid throughout—frames, floor and bulwarks; and with solid casemates, solid plating, guns, engines, commander and crew, she will doubtless prove a valuable addition to our national defences.

There are numbers of other iron-clads building in various parts of the city and suburbs, most of them far advanced towards completion.

THE APPLICATION OF MACHINERY TO COAL-CUTTING.

Mr. Samuel Firth read a Paper on this subject, before the British Association. The following abstract may prove interesting to our readers. While excavating machinery is used with such success in the great Mount Cenis Tunnel, it is not too much to expect its early introduction into our mines, under circumstances certainly not more difficult. Mr. Firth, in the course of his Paper, said:—

Numerous efforts have been made, during the last fifty years, to bring coal-cutting in mines under the influence of mechanical power; but in no case, I believe, except at the West Ardsley Colliery, has any continuous operation survived the experimental period.

I do not expect that the introduction of machinery into coal mines for the purposes named, would materially diminish the number of persons employed, but rather that the effect would be to meet the increasing consumption. That increase may safely be taken at two millions of tons per annum, and to supply this increase would require an annual increase of labourers amounting to about 3,500. Thus there will not be any displacement of labour.

The steam-engine has a 20-inch cylinder, and the air-pump 18 in. The air is worked at a pressure of about 50 lb. to the square inch. The air is conducted down the shaft in iron pipes of 4 in. diameter, and thence to the workings (about 800 yds.) in gas piping, and down the face by india-rubber piping of 1 in. diameter, which is connected to the machine. The machine is moved on iron rails laid on cross iron sleepers, and is propelled a little, after each blow of the pick, by the hand-wheel. Generally, the machine is passed three times over the face of the coal, each time with a longer pick, to gain the requisite depth for taking down. The first cut being 18 to 20 in., the second 9 to 11 in., and the third from 6 to 8 in.; 36 in. being the depth aimed at and accomplished. The actual quantity of work done in six consecutive days of eight hours each, by one man with one machine, was 618¼ yds., or about 800 tons of coal. The man is attended by two boys, who clean out the groove, and remove the coal thrown out by the machine. In the West Ardsley seam a man will average 7½ yds. of coal a day, so that if the machine were worked by shifts of eight hours, three men and six boys would do the work of forty men, and that, too, the most severe and trying work in the pit.

It must be understood that at West Ardsley the seam is somewhat favourable for the purpose. It is 4 ft. thick, having a good roof and floor, and is worked on the long-wall system, with a somewhat soft bareing part, about 12 in. above the floor, and in this the pick works. The comparison, however, with handwork is fairly made, because both work in the same part of the seam. The machine thus far has only been put to "bareing," or "kirving," but the proprietors expect to effect "straight-work" by a different arrangement of the picks. The filling, and all other work of the pit, is untouched by this machinery. The air-power works admirably; and its use gives a cool and refreshing stream of pure air to the far-distant works, which issues from the cylinder at a temperature very little above freezing-point. It will not be necessary to say here that the air-power is acquired by a much larger measure of steam power; but this is not a material item at a colliery, where so much engine coal is almost worthless. I am not prepared with the exact commercial results or saving in cost, but at West Ardsley this part of the question is, I believe, eminently satisfactory. I have been informed that some experiments have been made, within the last few days, at the Hetton colliery, by the West Ardsley machine; and although the seam is of a hard nature, the kirving was done 3 ft. deep with a groove of 3 in. at the face and 2 in. at the back, giving an average cut of 2½ in. high; whereas the average height of hand kirving in the same seam is about 11 in.

This saving of good coal from destruction is equal totan average of 9d. per ton upon the whole yield of the seam.

Another machine of a different principle has been invented at West Ardsley, and promises to be a most useful one. It is on the direct-action principle, with a to-and-fro motion, from a cylinder mounted transversely upon the carriage, and regulated in a similar manner to the pick machine.

This invention has not advanced so far as the "pick," but some recent experiments have given most satisfactory results. The complete success of this machine will be of great importance, as it will be more effective in "straight-work," "headings," and "drilling," than the pick.

In conclusion, I may express the confident opinion that, at no distant period, every branch of mining will be accomplished by machinery; and if we look at those results from a humane point of view, the sooner they are realized the better it will be for all parties, and especially for the working collier.

DECORATING MACHINERY.

The external appearance of some kinds of tools and utensils attracts public attention at once, and provokes criticism of a more or less favourable nature; according as the embellishment is in good or bad taste. In respect to the ornamentation of machines, many different opinions exist. There are a certain class of manufacturers who build their machines without any attempt at decoration, and who reject all outward show, as detracting from the real merit of the article—which lies unquestionably in its capacity to do the work it was designed for. Yet another, and in this country a very numerous class, so overload their mechanism with paint, gilding, and gewgaws, that the appearance becomes tawdry in the extreme, and detracts very materially from the pleasure one experiences in looking at what may be an otherwise well-designed and efficient machine. Some locomotive engine tenders we have noticed, are so covered with a maze of scrolls, scratches, and dabs of paint, beginning nowhere, and ending in the same place, that one cannot but think the ghost of some crazy artist had risen at the dead of night, and wandering at random over the innocent iron, left traces of his revel in wild meaningless blotches and patches, without character or purpose.

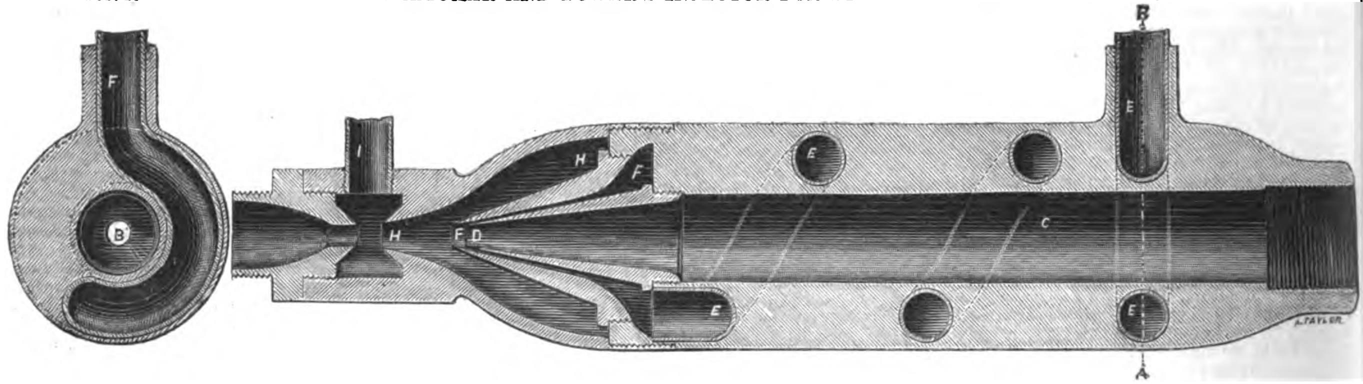
It seems to us that in all cases where the ornamentation of a machine is determined upon, a safe rule would be to consult the well-established laws of design (and common sense also), before perpetrating abortions which will, perhaps, live long after the offender against good taste has departed. All apparatus intended to be placed in an obscure corner, or those parts of machines which are not seen, require no outward adornment; but in other cases, where perhaps hundreds of persons daily use the apparatus, and the whole world, so to speak, criticizes and comments upon its appearance, a tasteful and appropriate exterior adds, not only to the beauty of the machine, but to its value, and is at once a mark of enterprise and an evidence of the maker's cultivation.—*Scientific American.*

IRON AND STEEL EXTRACTED FROM WASTE IRON CINDERS.

We have received a circular from A. L. Fleury, chemist, Franklin Institute, Philadelphia, in which he states that he has succeeded in extracting good wrought iron and steel from the waste cinders of puddling and reheating furnaces, which have hitherto been considered a nuisance in their vicinity. He states that, from chemical analysis, he is assured that such cinders contain from 25 to 50 per cent. of iron, combined with sulphur, silica, phosphorus, and alumina, forming a brittle compound. Near the large ironworks at Troy, N.Y., thousands of tons of these cinders are spread over the roads, and in every 100 lb. there are about 35 lb. of iron. By reworking this cinder with lime and charcoal, iron had been extracted, but it was invariably red-short (brittle at a red heat), as the sulphur, silicon, and phosphorus remained combined with the iron. Numberless unsuccessful efforts had been made to work this cinder economically. Mr. Fleury states that the problem of extracting the iron from the cinder and removing the impurities, was solved by taking advantage of the chemical fact that unslacked burnt lime possesses the property of decomposing silicates during the act of being slacked with water. He mixed a proper quantity of powdered burnt lime, with fine ground iron cinder, wetted the whole with water, and exposed the mixture to the atmosphere. When this compound was dry, it was placed in a common puddling furnace, treated like pig iron, and 50 per cent. of wrought iron was obtained. This product, however, was somewhat red-short, as it contained traces of sulphur, but the impurity—Mr. Fleury informs us—he afterwards extracted, by mixing a chlorine salt with the water which he employed to wet the lime mixed with the cinder; and a good quality of iron, we are informed, can be invariably produced when the operations are properly conducted. It is also stated that the cost of preparing the cinder does not exceed 2 dols. per ton, and the operation of smelting can be executed in puddling, blast, or other suitable furnaces. The invention has been patented in America and Europe. —*Scientific American.*

Mr. Spencer read a Paper (contributed by Mr. Page, the engineer of Westminster Bridge) "On the Foundation of Bridges," at the recent meeting of the British Association. After giving his own experience in such matters, he went on to describe the process of formation. The foundation, he said, might be described as a part of the structure which resisted the weight of the superstructure, and it was evident that the higher the horizontal place of the resisting mass was, the less was the weight of the superstructure upon it, and the better adapted as a foundation to resist its pressure. He then described the system he had pursued in the construction of four bridges over the Thames, and also of the pier at Greenock. He considered it important that the foundations of each pier should be one undivided structure, and should not be broken into separate parts, as it was in cases where cylinders were used; and that, besides the resistance due to the horizontal area of the foundation, it should embrace the additional resistance afforded by the friction due to the vertical surface of the pile, and this, short of founding on rock itself, would present the most solid resisting mass that could be found. The application of this system to harbours of refuge was a subject of great interest and importance at the present time, both for expedition in completing the works and for economy.

FIG. 2. FLETCHER AND BOWER'S INJECTOR FOR STEAM BOILERS. FIG. 1.



FLETCHER AND BOWER'S INJECTOR FOR STEAM BOILERS.

THE following improvements in injectors for steam boilers have been patented by Messrs. J. Fletcher and H. Bower, of Halifax, Yorkshire.

The improved injector consists of one pipe coiled spirally around another pipe, or of a pipe having a straight passage through its centre and a crust sufficiently thick to admit of a spiral passage being formed therein around the centra passage. The spiral passage opens at one end into a water supply chamber, and the other into a discharge or injection chamber, which is to be attached to the ordinary feed pipe of a boiler. The straight passage is connected at the water chamber end to a pipe which opens to the steam chamber of the boiler, and the other end terminates in the discharge or injection chamber at a point near to and concentrically with the outlet or orifice of the feed pipe. This apparatus is provided with taps or valves for regulating the flow of steam and water.

The construction of this apparatus, and the manner in which it is to be applied in practice, will be readily understood by reference to the accompanying drawings, where fig. 1 is a longitudinal section, and fig. 2 is a cross section taken through the line A, B, in fig. 1; C, is the central pipe or steam passage, which is formed at one end to fix to a pipe connected with the steam dome or steam chamber of a boiler, the other end is furnished with a conical jet D, which is of suitable size in its opening or outlet, and a variety of different sizes of jets may be adapted thereto; E is the spiral pipe or water passage, which runs spirally around the other pipe, and terminates in a conical chamber F, which has an outlet concentric with the steam outlet, and also to the disharge pipe or injection chamber H. The apparatus is screwed or may be provided with a flange so as to be connected at this end to the ordinary feed pipe of a boiler. The conical outlets or steam and water jets D and F can be set or adjusted by screwing them in or out; I is a "pet pipe" or overflow pipe.

The action of the apparatus is as follows:—When steam is applied or turned on to the central pipe C, and cold water admitted to the spiral pipe E at the entrance B, the steam sucks or draws the water in, and for a very short time steam blows out at the "pet pipe" I; a vacuum valve is applied to this pipe, which, as the steam becomes condensed, closes and stops the outflow of steam, the water still passing up the spiral pipe E, which, by the time it gets to the conical jet D, it becomes hot or warm enough to be driven by the steam through the feed pipe into the boiler.

This apparatus can be applied, with very little modification and adaptation of the parts, eithe to locomotive, marine, or stationary boilers, and it is also applicable as a force-pump on ship board, in breweries, distilleries, dye-houses, and for other purposes or places where a pump is required, and especially where there is no steam engine or other motive power engine to work an ordinary pump. It will be understood that the quantities and proportions of steam and water let into the respective pipes are regulated by taps or valves.

BLAKELY AND VAVASSEUR'S IMPROVEMENTS IN PROJECTILES.

THE following improvements in projectiles have been patented by Captain Blakely and Mr. Josiah Vavasseur, engineer, Surrey.

The invention consists in forming projectiles with grooves in the body and at the rear end for receiving lead or other soft metal.

The patentees prefer to form these grooves at an angle to the axis of the projectiles, and in the reverse direction to that of the rifling of the gun in which they are to be used, but the grooves may run parallel to the axis, and may be more or less long and deep, according to requirement. When the projectile is ready for use, there are alternate layers or strips of lead or other soft metal and iron or other metal of which the projectile is formed round the circumference thereof, the iron or other hard metal thus protecting the lead or soft metal from injury.

Fig. 1 of the accompanying drawings is an elevation; fig. 2, a similar view, partly in section;

FIG. 2. FIG. 1.

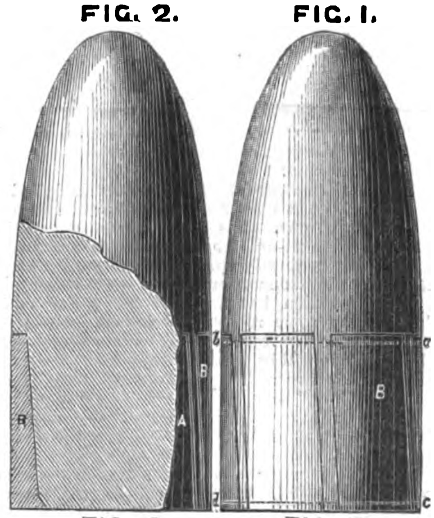
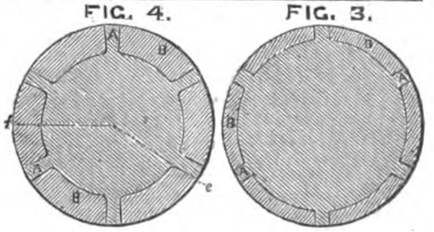


FIG. 4. FIG. 3.



and figs. 3 and 4 are cross sectons, through the lines a, b, and c, d, respectively of fig. 1, of a projectile constructed according to this invention with grooves formed in the body and at the rear end thereof at an angle to the axis of the projectile, and in the reverse direction to that of the rifling of the gun.

A, A, are the grooves which are filled with lead or other soft metal B. They are, b. preference, slightly undercut, as shown, so as the better to hold the lead or other soft metal. The patentees prefer to make the grooves shallower at the fore end thereof than at the rear, as seen in fig. 2, the sectional part of which is taken through the line e, f, of fig. 4.

PRICE'S IMPROVEMENTS IN SIGNAL LANTERNS.

THE following improvements in signal lanterns have been patented by Mr. John Price, of Southampton:—According to the provisions of the Merchant Shipping Act open boats under weigh will shortly be required to show a red light on the left or port side of the boat and a green light on the right or starboard side, and when at anchor will be required to show a bright light all round. Now, a single lantern, constructed according to this invention, can be used for each of these purposes. The lantern is, by preference, made three-sided; the upper half of each side is glazed with white glass, so that when neither of the glasses is covered a white light is shown all round. Fitting freely within the lantern is a trianguar frame, the sides of which are parallel with the sides of the lantern. This frame is of a depth equal to half the depth of the lantern, so that when this frame is in its lowest position it does not cover any of the glazed portion of the lantern. One side of the frame is glazed with red glass, and another with green glass; the third side is provided on its inner face with a mirror, thus when the frame is raised one of the glasses of the lantern will be obscured by the mirror, another will have a green glass behind it, and the third a red glass behind it, so that a red light will be shown on one side, and a green on the other. The frame can be raised by a pin or small projecting handle, which is screwed into the bottom edge of the mirror side of the frame; this pin or handle passes out through a slot in the side of the lantern, which is parallel with the mirror, and the frame when raised is retained in its highest position by a sliding bolt, which is then slid under the pin or handle; this sliding bolt also covers over the slot in the side of the lantern, to prevent too great a draught on the lamp. The side of the lantern which is parallel with the mirror is provided with handles, so that the lantern when held out in front of any one facing towards the bow of the boat, will show the proper light for each side. The top of the lantern is made capable of turning back on a hinge, so that when the pin or handle, if the interior slide is removed by unscrewing the slide, may be taken out at the top of the lantern, in order that the mirror and glasses may be cleaned. The lamp is inserted into the lantern through a hole in the bottom of the lantern, as is usual in signal lanterns.

Fig. 1 of the accompanying drawings shows a front view of a ship signal lantern constructed according to the invention; fig. 2 is a back view; fig. 3 is a vertical section, and figs. 4 and 5 are horizontal sections, taken respectively at the dotted lines (1), (1), and (2), (2), fig. 1.

a, a, a, is the frame of the lantern, which is, by preference, made with three sides a^1, a_2, a^3; the upper half of each of these sides is glazed with white glass. Within the lantern is the frame b; this frame is glazed on one side with red

PRICE'S IMPROVEMENTS IN SIGNAL LANTERNS.

FIG. 1.

FIG. 4.

FIG. 2.

FIG. 5.

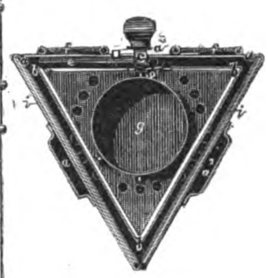


FIG. 3.

glass, on another with green glass, and on the third side the frame is closed and not transparent; but it is preferred to have a mirror or reflector on this side. The frame is capable of being moved up and down by the small projecting handle *c*, which moves in a slot *d* formed in the side a^3 of the lantern, but the raising or lowering the frame may be by other convenient means. The frame *b* is retained in a raised position by moving the sliding bolt *e* under the small projecting handle *c*, or the part may be otherwise retained in position. When the frame *d* is in a raised position, and the lantern is held by the handles *f*, *f*, a red light will be shown on the left or port side, and a green light on the right or starboard side, the light being prevented from passing out of the third side. When the frame *b* is in its lowest position a white light will be shown all round the lantern. The sliding bolt *c* also serves to cover the slot *d* when the frame *b* is in a raised position. *g* is the lamp, which is inserted into the lantern through a hole in the bottom thereof, and is held securely therein by the small projections g^1, g^1, which in introducing the lamp into its place pass through slots in the sides of the hole, and then the lamp is fastened in its place by turning it partly round. The top of the lantern is hinged to the upper part of the side a^3, and *h* is a small hook for securing it when closed. The sides a_1 and a^2 are provided with metal slides *i*, *i*, to obscure the light when necessary.

BATES' IMPROVEMENTS IN CANNON.

Mr. Benjamin Franklin Bates, of Morley's Hotel, London, has recently patented the following improvements in cannon.

In constructing cannon, according to this invention, a hole is formed through the breech end; this hole is smaller than the bore, and is parallel and concentric with it. Each projectile is provided with a long rod or bar, which in loading the cannon is passed through the hole in its breech; at the front end of the rod is an enlargement or head, which, however, is smaller than the bore; this head may be solid, or it may be formed into a shell; behind this enlargement is placed a loose disc which fits the bore accurately; the pheriphery of this disc may, if desired, be ormed of soft metal, and may also have lubricating material combined with it; the rod at the rear end of the projectile is, by preference, polygonal in section, with each of the sides winding spirally around the rod from end to end of its length, as though the rod were twisted; the hole in the breech end of the cannon is formed to fit and correspond with the bar, so that when the piece is fired, the projectile, in addition to being propelled forward, will at the same time be caused to revolve on its axis. The loose disc behind the head of the projectile, by preference, does not rotate with the projectile, but the rod of the projectile turns in a hole in the disc; as soon as the projectile leaves the gun, the resistance of the air will cause the disc to slip off the bar at its rear end, or the disc may be made to separate into two or more pieces as soon as it leaves the gun. If desired, the hole through the breech end of the gun may be closed, as soon as the rear end of the projectile passes out of it, by means of a sliding piece pressed forward for that purpose by a spring. The hole in the breech end of the gun may be provided with a close-fitting plug; the gun can then either be used to propel a shot, such as above described, or when the plug is fixed in the hole the gun may be used as an ordinary smooth-bore gun.

Fig. 1 shows a section of a cannon constructed according to this invention; fig. 2 shows the breech end of the cannon.

BATES' IMPROVFMENTS IN CANNON.

FIG. 2.

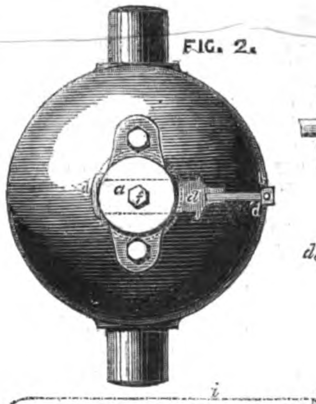


FIG. 1.

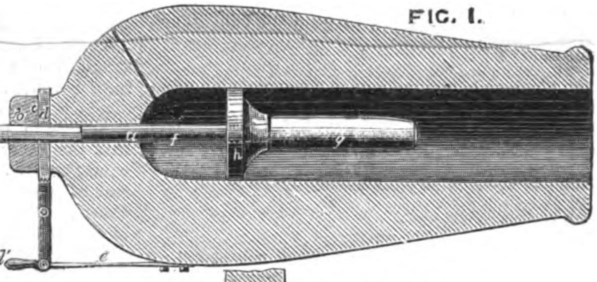
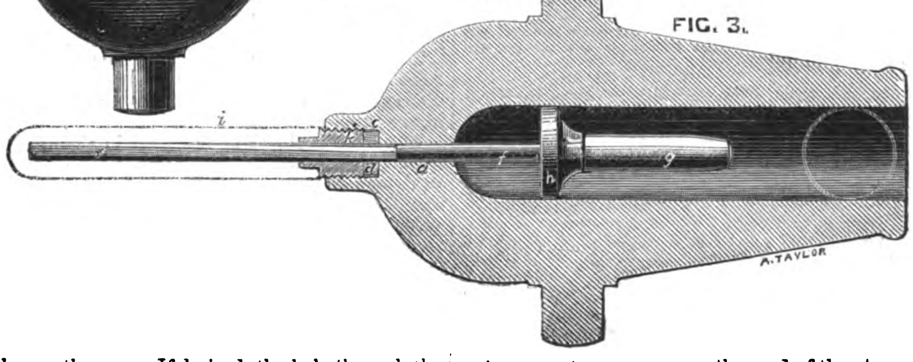


FIG. 3.



a is the hole at the breech end of the cannon; this hole is, by preference, made sufficiently large for the rod or stem of the projectile to pass freely through it, and behind the breech is bolted (as is shown at fig. 2) a piece *b*; this piece has also a hole made through it sufficiently large for the rod or bolt to pass through freely; through the piece *b* is a slot *c*, in which is a sliding piece *d*, made of steel; in this sliding piece is a hole, which accurately fits the rod or stem of the projectile; the slide *d* is constantly pressed on by a spring *c*, so that, as soon as the end of the stem or rod passes beyond the hole formed in the slide, the slide will be moved forward so as to stop up the hole through the breech. In loading the gun this slide is held down by the handle d_1, so that the hole in the slide shall correspond with the hole in the breech, there being stops on the slide which prevent it being lowered too far; the projectile is inserted at the muzzle of the cannon, and is pressed home in the ordinary way; the powder is, by preference, contained in an annular bag or case, so that the rod of the projectile may be inserted through it before the projectile is

placed in the gun. *f* is the stem or rod of the projectile, at the foremost end of which is the head *g*; this head, as above stated, may be solid, or it may be formed into a shell; the front end of the head is shown in the drawing to be shaped like the head of a punch, but it may be made rounded or otherwise formed; the rod or stem is of a section to fit the hole in the slide *d*; this hole is, by preference, six-sided, as is shown in fig. 2, but it may be of other form; the portion of the rod that passes through the hole is twisted from end to end of its length, as is seen at fig. 3, so that when the projectile is fired from the gun it will be caused to rotate on its own axis; *h* is the loose disc at the back of the head of the projectile, the periphery of which is made to fit the bore of the cannon. The disc is shown at figs. 1 and 3, to be in one piece, but it may, as before stated, be made in two or more pieces, so that it may readily separate as soon as it passes out of the cannon. Fig. 3 shows a cannon constructed in such a manner that the piece *d*, through which the hole is formed that corresponds with the section of the rod of the projectile, is held stationary, in place of having a sliding motion given to it, as in the arrangement just described; the piece *d*, in the arrangement shown, is held in its place by the screw plug *k*, and is prevented from turning by its being formed hexagonal on its outer circumference, and fitting within an hexagonal hole formed to receive it.

Meetings for the Week.

SAT.—*London Association of Foremen Engineers.*—" On an Entirely New Method of Coating Telegraph Wires," by Mr. Miller, at 8 p.m.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

All communications should be addressed to the EDITOR, 166, Fleet-street.

RECEIVED.—C. G.—W. H.—S. B.—D. G. F.—C. F. Y.—S. T.—Z. C.—H. R. E.—R. A.—A. L.—J. H.—J. W.—W. W.—Capt. S.

NAUTICUS.—Next week.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Could you recommend us some good and cheap way of warming our place of worship? It is 17½ yds. long by 10½ wide, no gallery; was built five years ago. If you can give me the address, or refer any maker to me, you will oblige

Yours truly,
56, Hope-street, Wrexham. CHAS. HUGHES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Do you consider a 1 inch chain sufficiently strong for a crane to lift 10 tons?—By answering the above question you will greatly oblige

Yours truly,
Leeds, Sept. 21, 1863. D. R.

[If the chain works over a double tackle pulley it is strong enough, not otherwise.—ED. M. M.]

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

TORPEDOES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—By the recent discussions upon the properties of gun-cotton, we have, to some extent, been enlightened on the subject of torpedoes.

The sentiments of Capt. Maury as to the employment of such destructive engines, as a means of defence, must, I think, be generally accepted. A Confederate, owing allegiance to the Confederate States—serving in defence of Charleston—would be justified in his endeavour to hoist to the clouds any Federal vessel that might come into the harbour of Charleston upon the compassionate mission of destroying the town—burning or horribly mutilating its inhabitants. In summarily disposing of the invading foe, the Confederate would not be diverted from his purpose, though depending upon the aid of his Satanic Majesty.

Those who have looked into the histories of engines of war, have learnt that any mode of destruction, that was not in keeping with the prejudices of the day, was proscribed as villanous. Gunpowder and guns were abhorred by the warriors of old; torpedoes, in turn, appear to be held in about the same estimation by warriors of this day. But, taking a common-sense view of the matter, we cannot fail to see that, when men set about fighting in right good earnest, there is no restraint upon the disposition to finish off each other by any available means which they may respectively possess—either in the material, or in the science, art, or strategy of war: so it will be, as it has ever been, during the existence of pugnacious man.

With regard to the explosion of the torpedo in the River James, it could not, I think, have been in hugging contact with the vessel intended to be destroyed when it exploded. A very much smaller charge than 1,000 lb. of gunpowder would have been sufficient for the purpose, if properly exploded. There is not, however, a doubt that a more violently explosive agent than common gunpowder is better adapted to the charging of torpedoes; for the effect of gunpowder in relation to the more violently explosive agents, is as pressure to percussive force. From what has been stated of gun-cotton, it is likely to do its work effectually, even under the disadvantage of the torpedo not being, when exploded, in *contact* under or alongside of the vessel attacked. Like results would, I confidently believe, obtain, under similar conditions, by the employment of Horsley's powder, which, for such work, is, I think, the more desirable agent of the two.

Torpedoes may be of any suitable form and strength of material. If made of stout boiler iron, I would recommend their being of a size to displace, when charged, a quantity of water a trifle less in weight than their own weights, so that they may require only small buoys to suspend them at any desired depth below the surface of the water. It may be desirable that, in charging torpedoes, they should not be completely filled by their respective charges; the space occupied by the charge may be partitioned off by a slight diaphragm, keeping the charge at the bottom of the torpedo, and so ensuring the perfect action of the exploding apparatus.

The means of exploding by galvanic arrangement may be found to answer under certain conditions, but I think there is a better means—a means generally applicable.

When the problem of the torpedo shall have been solved, it will be found that it can be very easily and effectively managed in "blue water," and that it will be better to encounter invading vessels at sea than wait till their arrival in rivers or harbours.

I remain, your obedient servant,
JN. HARVEY, Capt. R.N.
5, Keynsham Parade, Cheltenham,
Sept. 19, 1863.

STEAM BOILER EXPLOSIONS.

Sir,—You appended a foot-note to my letter last week as follows:—"We have inserted Mr. Hopkinson's letter, though we are at a loss to understand its object."

My object was to have inserted that portion you omitted, and instead of saying "your contemporary, the *Engineer*," you should have said "Mr. Zerah Colburn, the editor of the *Engineer*." I intended to convey to your readers that Mr. Colburn was not entitled to the praise he was continually lauding upon himself, regarding his great discovery of the explosive properties of water; but, as the name was omitted by you, my object was not attained.

Your remarks remind me of a circumstance which occurred some years ago. I wrote a letter on this subject, which I forwarded to the two Manchester daily papers. One editor published the fore part of the letter, and appended a footnote that the latter part of the letter did not apply to the question; and the other editor published the latter part of the letter, stating that the fore part did not apply to the subject, and betwixt the two papers the whole letter appeared.—Query, Which of the two was right?

In your case there cannot be any query, providing you be the judge; therefore, taking for granted that you were right, I perused your article on "Boiler Explosions," to obtain further information, and found that your conclusion was—"That this store of power is nothing but a store of heat." This I have long known; but I am waiting to know what heat is; and if you or your readers will define what heat is, "the boon will be conferred upon the scientific world."

The fact is, Sir, that Mr. Colburn has been endeavouring to make us believe that the explosive property of water when charged with heat, was discovered by him in 1859 and unknown before. A country editor of ours, viz., the *Huddersfield Chronicle*, in 1857, in a leading article on boiler explosions, uses these words:—"By these means the internal contents of the boiler—the steam and the water—charged with a high degree of pressure or heat, became suddenly liberated; and these possessing immense *expanding* force, exerted that force, and produced the disastrous results before described."

In my report to the coroner and jury on the same explosion alluded to in the former extract, were as follows:—"In my opinion, at the time of the bursting, the pressure in the boiler would be somewhere betwixt 75 and 100 lbs. to the square inch, the water being at a temperature from 310 to 330 degrees. The flue and ends appear to have been shot straight out, and not against the roof of the boiler-house. The cause of the building falling would be from the expansion of the steam and water on their release from the boiler, charged with such a high degree of heat."

Mr. Fairbairn, who followed in his evidence on the same occasion said:—"The former collapsed from compression on its exterior surface, and the fracture which gave vent to the elastic power of the pent-up steam was quite sufficient to account for the results that followed—namely, the demolition of the buildings, and the projection of the boiler, flues, &c., into the positions in which they were found."

Therefore, taking recent dates, say 1857, and omitting former authorities, we stand in order thus:—

1. Editor of *Huddersfield Chronicle*.
2. Myself.
3. Mr. W. Fairbairn.
4. Mr. Zerah Colburn.
5. Mr. D. K. Clark.
6. The Astronomer Royal.

Yours respectfully,
J. HOPKINSON.
Britannia Works, Huddersfield,
September 22, 1863.

GUNS FOR THE NAVY.

SIR,—On reading the excellent article on "Guns for the Navy" in your last number, in which you recommend such a moderate rifling as "to impart just such a velocity of rotation and no more, to an elongated projectile, as will secure it from turning over in its flight," it occurs to me that the desired rotation might be obtained by discharging a Whitworth projectile from a smooth-bore. If the air is able to destroy a great part of the motion of the projectile, much more will it be able to modify that motion, and impart a moderate rotation to the shot, by impinging on the twisted hexagonal planes of its exterior.—Yours, &c., R. A.

Edinburgh, Sept. 23, 1863.

Miscellanea.

A project has been broached in New York for paving the streets with iron and conducting the traffic by steam carriages moving on these iron floors. It is urged that the saving to clothing, furniture, and goods from damage by dust and mud would be enormous; that the resistance on clean iron floors would be small, the wear on carriages slight, and the noise but trifling in comparison with what it is at present. Shoes, it is represented, would wear much longer on iron side-walks than on stone.

Preparations are now being made by the contractors for commencing the construction of the large semicircular casemated fort at the entrance of the Medway, which is intended to guard the passage to Chatham harbour, the foundations having been completed some time since, and a sufficient period allowed to elapse to secure their consolidation. The position of the fort will enable it to effectually bar the passage of any ships attempting to approach either Sheerness or Chatham dockyards. It is intended, on the completion of this and the other forts which command the approaches to the Medway, to arm them with the most powerful description of guns, throwing the heaviest projectiles, recent events at Charleston proving that forts are only superior to ships in exact proportion to the description of armament used.

The Atlantic Royal Mail steamship "Adriatic," on her recent outward voyage, made the run from Galway to New York in ten days four hours, including detention to land mails and passengers at St. John's, Newfoundland. This is 24 hours under the contract time.

The New York papers describe the experiments made by a Mr. Solomon Andrews, of New Jersey, with a new flying machine. Its form is that of three cigars pointed at both ends, secured together at their longitudinal equators, covered by a net, and supporting by 120 cords a car 16 ft. below under its centre. The car is 12 ft. long, made of basket work, and is 16 in. wide at the bottom. The aërostat, or cylindroids, are made of varnished linen, like ordinary balloons. On Friday, the 4th instant, he made his last experiment, and demonstrated to an admiring crowd the possibility of going against the wind, and of guiding her in any and every direction with a small rudder having only 17 square feet of surface. After a few short flights, to satisfy himself and a few friends that all was right, and that she would do all he had contemplated, he set her off in a spiral course upward, she going at the rate of not less than 120 miles per hour, and describing circles in the air of more than 1½ miles in circumference. She made twenty revolutions before she entered the upper strata of clouds and was lost to view. She passed through the first strata of dense white clouds, about two miles high, scattering them as she entered in all directions. In her upward flight could be distinctly seen her rapid movement in a contrary direction to the moving clouds, and as she came before the wind passing by them with great celerity. As she was distinctly seen thus to move, both below and above the clouds on the clear blue sky at five o'clock p.m., with the sun shining clear upon her, there could be no mistake or optical delusion to the beholder.

The steam-rams at Birkenhead are rapidly approaching to completion. "El Tousson" wants but little to fit her for taking stores; "El Mounassir" is not far behind; both the rams are as well-designed for swiftness as for strength. Their length each is 230 ft., their beam 42 ft., and their extreme depth less than 20 ft. The burden is about 1,500 tons register, and the draft of each vessel when loaded will be some 15 ft., being about 6 ft. above the water-line, all the intermediate surface being protected, first, by a coating of teak over the iron skin of the ship, and then by armour plates over that, each massive scale being 5½ in. thick. All this armour is dove-tailed together so accurately, that the joints are scarcely perceptible. The deck is of 5-inch teak, covered with iron, and the bulwarks are also of iron, being so made as to let down outwards, and thus to clear the decks during action. Two revolving cylindrical turrets, on the well-known principles invented by Captain Coles, are apportioned to each ship, one turret being before, and the other abaft her engine-room. There is also a pilot-house, strongly built of teak, and iron-plated. Each turret carries two guns, placed in close proximity, so that they can be brought to bear nearly in the same position at one time. In the case of the "Mounassir," one turret is being fast completed on a spot situated at some little distance from the hall; and the plan of construction, being at present laid bare, cannot but raise admiration in every beholder. Its wall is a series of cellular spaces, like the chine of a shell-fish, and all these iron cells are to be filled up with teak, making one solid and uniform mass, which is to be again strengthened and rendered well nigh impregnable by armour plates. At each end of the vessel is a raised deck, forming tolerably commodious quarters for officers and men; and the forecastle is made to carry one or two heavy guns, if they be needed. In the captain's cabin are port-holes for two 32-pounders; and each ram has capacity for 300 tons of coal. The machinery, as a matter of course, is all below the water-line. In one of the storehouses are the telescopic iron masts and yards of the two rams, which, as it seems, are to be barque-rigged. Their sterns will be so formed as to protect the screw and rudder from shot or collision.

During the furious assault upon Fort Sumter, the first shot fired from the 200-pound Parrott rifle penetrated 9 ft. into the wall facing Sullivan's Island, after first passing through the gorge wall of the fort; it knocked over a pile of brick upon a steamer outside of the wall, demolished its smoke-stack, and caused the boiler to burst, by which casualty four negroes were killed.

The "Great Eastern," which arrived at Liverpool on Sunday morning, while off Cape Clear on Friday evening, ran down a ship called the "Jane," Captain Duff, bound from Liverpool to Quebec. Two of the crew of the latter were unfortunately killed by the collision. The "Jane" left Liverpool on the 6th inst.

The effective measures adopted to stop the lamentable fire in the Wellington coalpit at Whitehaven are fast approaching completion. A drift has been cut from the up-cast shaft to the sea, and there is a communication from the beach to the pit. It is expected that in a few days the fire will be entirely subdued.

The large fort now in the course of construction at Portsmouth, near Southsea Castle, is to be provided with a cupola shield, on the plan patented by Captain Cowper Coles.

American green-back bank notes are coloured with green ink, which cannot be photographed nor dislodged by alkalies.

During the last few days the holders and speculators in petroleum at Rotterdam have been thrown into a state of the utmost consternation and excitement, owing to the surface of the water in the river and canals being covered with petroleum, that must have escaped by leakage. During May, June, and July, large quantities of the commodity were imported and duly stored in the bonded warehouses of the city. It is now ascertained that a frightful quantity must have escaped, for not only are the river and canals covered with it, but it has penetrated into the wells, and impregnated the water in them with a most unpleasant taste. Not only is there no good water to be had for drinking, but the populace expect a general conflagration of the city from the incautious application of a lighted candle, or even a match falling in the water anywhere. The price of the article has already risen 20 per cent., in consequence, and a further advance is confidently expected.

The two large masses of rock in the Menai Straits, known as the Cow and Calf Rocks, and which have for so long impeded the navigation of the Straits, are now about being removed. Several masses have been blasted and taken up under the direction of Mr. W. B. Hicks, of Falmouth, who, with a number of other divers, is making rapid progress with their removal.

The *Toulonnais* says:—Private accounts from Pais announce that a certain number of iron-clad vessels, designated by the name of "Bull-dogs," are about to be put on the stocks. This kind of vessel will be, it is said, a complete event in naval architecture, and they will be constructed on an improved plan, resulting from the examination of a dozen projects of different kinds, from which that considered as the best has been selected.

Last Tuesday, an action was brought in the Manchester County Court, before Mr. W. Saunders, deputy judge, the plaintiffs being Messrs. Perera, Spanish merchants, Deansgate, and the defendants Messrs. Bellhouse, engineers. The action was brought to recover £50 for damages sustained by reason of the breakage of an hydraulic press furnished by the defendants. In 1858 the plaintiffs supplied two presses and pumps to the defendants, at £120 each press. The rams were to be 10 in. in diameter, and the pumps and presses were to be of a first-class character, and capable of sustaining a pressure of 3 tons to the square inch. The machines were put down and paid for, and appeared to work well till the 6th of July. On that day the bottom of one of the presses broke with a tremendous crash; the top and pillars flew off, the foundation was injured, and great damage was done. On examining the fragments of the machine, it appeared that the middle of the press bottom, which should have been the strongest portion of the machine, was the weakest. It had a large flaw, the iron was spongy, and the casting appeared to have been weakened by what seemed to be a lengthening. The pressure at the time of the accident was only 2 tons 9 cwt., which was the highest the machine had ever been worked at.—A number of practical and consulting engineers were examined on each each side, and their evidence was very conflicting. The plaintiffs' witnesses swore that the machine was so lightly constructed and so made that it was impossible to sustain a pressure of 3 tons. On the other hand, the defendants' witnesses proved that, making full allowance for the defective casting, the machine was quite capable of sustaining a pressure of 6 tons. They attributed the cause of the accident to a fracture, which had probably arisen months before the accident, through what was possibly carelessness in the use of the machine.—The case occupied the court about five hours; and, as it presented a large number of points for consideration, the learned judge reserved his decision.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

420. R. A. Brooman. *An improved cover or protection for steel and other metal springs, ribands, and hoops.* (A communication.) Dated February 16, 1863.

This invention is intended chiefly to apply to protecting or covering the metal ribands used in the manufacture of "crinolines," but it applies to metal springs, ribands, and hoops generally. It consists in winding spirally on such springs, ribands, or hoops, one or more strips of paper, stamped, coloured, or plain, or in encasing the springs, ribands, or hoops in sheaths of paper or papier mâché. *Patent completed.*

421. W. Jackson. *Improvements in pumps.* Dated February 16, 1863.

This invention is intended chiefly to apply to ships' pumps, but it is applicable to pumps in general. The inventor causes the suction pipe to terminate at top in a bend, and at the bottom of the bend he fixes a box; at right angles (or nearly so) to this box, he fits the pump barrel; the bucket is connected by a rod to one end of a rocking beam. The other end of this beam is furnished with a friction roller, and the beam is made to rock or reciprocate, so as to communicate the requisite motion to the bucket by means of a cam mounted upon a shaft, to which rotary motion is communicated by a crank handle or otherwise. *Patent abandoned.*

422. J. H. Haywood and W. Vernon. *Improvements in packing bonnet fronts, rouches, and other similar articles.* Dated February 16, 1863.

This invention consists in constructing a spindle or spindles of any required size and shape, and composed of wood, paper, or other material, and of the requisite length of or for the articles to be packed, upon which spindle or spindles the inventors fix two or more pieces of

perforated cork, india rubber, or other material to form cushions, to which these articles are attached by tacks, pins, or hooks; or they fix upon these spindles two or more collars of tin, pasteboard, or other material, in which are punched any required number of slits or grooves, into which the goods to be packed are placed. And, further, to protect the articles from pressure in carriage, transit, or otherwise they fix pieces of wood, wire, pasteboard, or other material of different shapes at the ends, and at intervals on the spindles, and of such length that the ends protrude beyond the articles, and which also hold two or more longitudinal pieces of wood, pasteboard, or other material, which will produce the goods lengthwise. *Patent abandoned.*

423. S. W. CLOUGH. *Improvements in signalling on railways.* Dated February 16, 1863.

This invention consists—1, in the combination of a signal light or lights with apparatus to be worked by the passing of an engine or train over the rails of a railway, whereby the cover or covers will be withdrawn from a lamp or lamps, and allow the same to be displayed to view by the pressure of the engine or train on a piece of metal let into a recess formed in the rail. 2, The invention consists in the adaptation to railway carriages of lamps fixed either in the roof or to the side or sides thereof, so as to be capable of displaying a signal light by the removal of a cover from the lamp. The cover in this case is removed as required by means of a rope or cord connected to one end of a lever, the other end of which is connected to the cover, such rope or cord being attached to a crank shaft running the whole length of the carriage, intended to be pulled by passengers when required. *Patent completed.*

424. W. NALDER. *Improvements in rotary screens, and in the machinery or apparatus employed in the manufacture of such screens.* Dated February 16, 1863.

This invention relates—1, to an improved construction of rotary inclined screen, whether of a cylindrical or polygonal section, and consists in the introduction into the interior of the screen of a metal or other cylinder or drum, extending either entirely or partly along the length of the screen. This internal cylinder or drum is carried by the spindle of the screen, and revolves with it; it is closed at the upper end, and is of smaller diameter than the interior of the screen, so as to leave an annular space of convenient width between it and the screen, to allow of the passage of the corn or other substances to be screened. The object of this internal cylinder or drum is to prevent the corn or other substances from being unduly agitated by the rotation of the screen, and to keep it down upon the screening surface. It is adjustable on the spindles, so as to be capable of being shifted to any desired portion of the length of the screen. The second part of the invention relates to certain peculiar constructions, arrangements, and combinations of machinery or apparatus for manufacturing cylindrical or polygonal rotary screens of wire of any section, or other suitable material, whereby considerable economy in their manufacture is obtained, with a better and more perfect article. *Patent completed.*

425. T. WILKINSON. *Improvements in machinery or apparatus for singeing pigs.* Dated February 16, 1863.

This apparatus consists of an iron chamber, open at both ends, and having its interior longitudinally furnished on opposite ends with tubes perforated so as to emit jets of gas. Sufficient room is left in the centre of this chamber for the carcases to pass through between the gas jets on either side. Running longitudinally through the chamber, and near the top—which has an arched roof—is a track supported on uprights at either end, upon which is placed a small truck, and this truck is set in motion by an endless chain passing through the chamber. The chain runs through wheels at both ends. The pigs are hung from the truck, and the motion which the wheels of this truck acquire in passing along the track communicate to the carcases hanging from the truck a rotary motion while passing through the chamber between the ignited gas jets, so that on issuing at the opposite end they are perfectly singed. The whole machinery is put in motion by a windlass in immediate connection with the endless chain. The gas is supplied to the jets by a single large tube on either side. *Patent abandoned.*

426. T. W. SALMON. *Improvements in washing machines.* Dated February 17, 1863.

This invention consists in the combination of a moveable box to contain the clothes or articles to be washed with a reciprocating frame, the relative motions of such box and frame in opposite directions being adapted to wash the clothes or other articles with increased rapidity. The bottom of the box on which the clothes or other articles are placed is formed or furnished with a series of flutes or cross bars, with spaces between them, and the bottom of the reciprocating frame is also formed or furnished with similar flutes or cross bars, also with spaces between them, the clothes or other articles being placed between the two operating surfaces of the box and frame. The box rests on friction rollers mounted in a stationary frame, or is mounted on rollers running on such frame, and is worked to and fro by means of a lever having its fulcrum in fixed standards. The reciprocating frame is also connected to the said lever, and is suspended on two cross shafts or axes resting on the said fixed standards. By this combination of mechanism the required relative motions are imparted to both the box and the reciprocating frame by working the said lever. The reciprocating frame is adjusted as to its distance from the bottom of the box by raising or lowering the standards on which its cross shafts or axes rest, and fixing them at the required height. *Patent completed.*

427. J. LEE. *Improvements in ploughs and harrows.* Dated February 17, 1863.

This invention consists—1, in forming the handles and beams of ploughs of wrought iron gas tubing or piping, such as at present commonly used by gasfitters, the object being to lessen the weight of ploughs, without lessening the strength and durability thereof. This invention consists—2, in forming harrows of gas tubing, arranged in four or more separate squares, each connected at the centres of their inner sides by links, and in imparting to the said squares a side movement. *Patent abandoned.*

428. W. T. DIPR. *An improvement in brewing.* Dated February 17, 1863.

Hitherto it has been the practice in that part of the operation of brewing known as mashing to use the malt at a temperature as low as that of the surrounding atmosphere, and for the purpose of obtaining the malt cool where fresh malt has been used it has been allowed to remain some time after the malting to become cool. Now, the inventor has discovered that better effects are obtained by using the malt at a temperature of from 80 to 120 degs. Fahr.; and this invention consists in the employment of malt for the purpose of mashing raised to a temperature of from 80 to 120 degs. Fahr. He prefers for the purpose of the invention to erect a drying or heating kiln adjacent to the mash tun, and having raised the malt to the required temperature as above-named, he passes it through rollers to be crushed directly into the mash tun. *Patent abandoned.*

429. W. C. FORD. *An improvement in paddle-wheels.* Dated February 17, 1863.

In carrying out this invention, the inventor makes use of a wheel with arms and rings, in any usual manner, but instead of all the buckets being equidistant from the centre, he places them in three ranges, so that each alternate arm carries two buckets, while each intermediate arm carries one bucket midway, or nearly so, of the other two, in order that it may act against the water that passes between the two preceding buckets. He also makes the buckets of a prismatic form, in order that they may shed off the water more quickly as they rise, and also that their action in the water shall be that of an inclined plane forcing the water away from the wheel, and making it more dense for the paddles to act against, instead of rising within the wheel in a form as heretofore. He also makes the said prismatic buckets of sheet metal, with an armhole for access in making repairs, and the sheet metal ends of these prismatic buckets are made with flanges, by which the buckets are secured in place. *Patent abandoned.*

430. J. GIMSON. *Improvements in presses for punching or cutting out leather and other substances.* Dated February 17, 1863.

This invention relates to that description of presses in which knives or cutting tools with sharp edges, bent in any desired form, are used to cut out pieces of particular shapes. These cutting tools are usually made about two inches deep, and two, three, four, or more tools are frequently adapted to the same press simultaneously, in order to economize time and labour; but, as the knives or cutting instruments, and also the under blocks, do not always wear away equally, great difficulty is experienced in using in the press at the same time several knives and blocks of different depths or thickness. The object of this invention is to obviate the inconvenience arising from using knives and under blocks of different depths or thickness, and to this end the patentee adapts to, or employs in combination with, the moveable part of the press as many adjustable pressing surfaces as there are knives or cutting instruments, so that each pressing surface may be adjusted separately to suit the knife with which it is intended to be employed. He prefers that this adjustment should be made by means of adjusting or set screws, so that the pressing surfaces may be screwed up or down, according to circumstances. *Patent completed.*

431. E. DEVILLE. *Improvements in floating or life preserving coats or garments.* (A communication.) Dated February 17, 1863.

This invention relates to a combination of parts whereby a person unable to swim may be supported in the water above the armpits in a vertical position, without the possibility of sinking, even supposing he should endeavour to do so. These parts are two in number, and consist—1, of a tunic having a skirt formed of two thicknesses of material united together as hereinafter described, the intervening space being filled with from 4 lb. to 5 lb. weight of cork cut up in small pieces; 2, of the ballast, varying in weight from 2 lb. to 8 lb., which is placed on the legs above the ankles. The tunic or body and shirt thus padded with cork will support the body out of water. The ballast being placed near the feet keeps them down and maintains the body in a vertical position as in diving dresses. *Patent completed.*

432. J. DURANT. *Improvements in chimney tops.* Dated February 17, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

433. G. HOME. *Improvements in projectiles.* Dated February 17, 1863.

This invention consists in making apertures, depressions, or cavities in the bullet, and inclined in such a way that the gas of explosion acting upon their closed ends gives a rotary motion to the projectile. *Patent abandoned.*

434. J. W. LANE. *Improvements in fastenings for studs, sleeve fasteners, solitaires, bracelets, brooches, and other uses.* Dated February 17, 1863.

This fastening consists of two parts, one part being a box containing the fastening or locking mechanism of the kind hereafter described, and the other part containing a projecting piece or shank which is to be fitted or locked into the box. The box is provided with an orifice, through which the shank can be introduced, and at each side of the orifice spring catches are provided, which consist of latch or catch piece or pieces which are bent or formed with a "bridge," in order that the inner end of the latch or catch may be kept flat against the inner surface of the box part hereinbefore mentioned. The outer ends of these catches or latches project through orifices beyond the edge of the box part. The shank on the other part of the fastener (such shank having a groove or notch therein) has to be introduced by pressure into the proper orifice, and by the action of the latches or [illegible] becomes locked or fastened, unfastening being effected by pressing the ends of the latches or catches aforesaid. The latches or catches are secured to the box by screws or studs, situate in cuts or openings, and are acted upon by springs. *Patent abandoned.*

435. S. PLUCHART. *A new kind of food for horses.* Dated February 17, 1863.

This invention consists, principally, in preparing food for horses, of straw, hay, or other fodder or forage cut into chaff, of pounded, crushed, bruized, or pulverized oats, gluten, and salt, to which is also added (likewise in the crushed, pounded, bruised, or pulverized state) horse beans, barley, linseed or linseed cake, Indian corn, buckwheat, beet root, potatoes, or other edible vegetable products suitably cut into chaff, pounded, crushed, bruized, or pulverized, according to their nature, and further pulverized bones, or suitable calcareous salts, drastic, or other suitable medicinal products, according to the effect to be obtained. The various substances are to be well mixed together, pressed into balls, bricks, or other suitable forms, and allowed to dry, more or less, as required, and given to the horse in that state, or broken into pieces, pounded, or mixed up with water or other liquid in the cold or warm state. *Patent abandoned.*

436. H. TOMLINSON. *Improvements in stoves or fireplaces for warming apartments.* Dated February 17, 1863.

According to one modification for carrying out this invention, as applied to an open or closed grate, a lateral grating or series of bars is made in each side of the fire-holding portion of the grate, through which gratings a considerable proportion of the products of combustion pass into a lateral flue partially surrounding a hot-air chamber formed in each of the cheeks of the stove—that is, one on each side of the fire. These lateral flues or passages open into horizontal flues at the upper part of the stove, and communicate respectively with two branches of an external arched flue provided with dampers, and fitted on to the top plate of the stove, the crown of the arched flue having a transverse partition made in it to keep the two lateral flues separate until they both unite in one common flue at the crown of the arch. A transverse partition is also placed across the mouth of the main aperture from the body of the fireplace from front to back, such partition extending across the middle of the horizontal flues above referred to, so as to divide such flues transversely. The front and back portion of these flues are separated by a longitudinal partition, which has the effect of forming a hot-air or smoke chamber in the top front part of the stove. The orifices of the two branch flues extend partly over the back portion of the horizontal flues, so as to enable the products of combustion passing up through the mouth of the main aperture immediately over the fire to be carried up the branch flues with those products which pass off through the lateral gratings and flues. *Patent abandoned.*

437. D. TASSIN. *Improvements in preventing the explosion of steam boilers.* Dated February 17, 1863.

It is known that explosions usually occur when the steam engines are at rest, and when the steam may be said to be at a mean pressure in the boilers—that is to say, when the stone float can sway or move freely at the least bubbling of the water. The patentee states that he has ascertained that it is elasticity which causes the explosion of steam boilers. The stone float of a steam boiler has through its centre an iron clasp suspended on a copper wire; when the water contained in a boiler happens to be more or less impregnated with acid or alkali, the least movement which takes place in the float causes a shock or friction between the two different metals (iron and copper) that are in contact, and the electric spark is produced at their point of junction, and thence comes the explosion. This invention consists in preventing these electric sparks, and, consequently the explosions of steam boilers by electricity in the following manner:—In place of employing two metals to the stone float, he only uses one metal both for the clasp and for the suspending of the float, for which reason the clasp, as well as the wire which suspends or sustains the stone float, he makes of copper, and by using only one metal the same will not be capable of emitting electric sparks under the circumstances above mentioned, and electric explosions will be thus prevented. *Patent completed.*

438. E. STRAWSON. *Improvements in the manufacture of buttons, which may be instantaneously attached without sewing.* Dated February 18, 1863.

This invention consists in forming a button in the shell form; a small hole is made in the face near the edge, and a large one in the centre of the back; a curvilinear pin is passed through the hole in the face, and takes hold of the material to which it is to be attached through the hole in the back, and is then forced into the inside of the button, which can be turned round on it, and so make it perfectly secure. Another mode is to have a hole stamped in the back of the button, the edges of which are turned inwards, and the fastening is formed of a piece of wire in the shape of a staple with harpoon points, which is forced through the cloth, and into the hole in the button, which compresses the points till they have passed the inverted edge, when they immediately expand from their own elasticity, and form a secure fastening, allowing the button to revolve. Another mode is to have a hole stamped in the back of the button, the edges of which are turned inwards, and the fastening to which is formed of a piece of bent wire, with the ends turned down or terminating in harpoon points, which is first forced through the cloth, and then into the hole in the back of the button, when the ends hook over the edge of the flange, and are perfectly secure, at the same time allowing the button to revolve. To attach buttons to leather garments, a ring of leather is doubled together; two holes are made in the material to which it is to be attached, through which it is then passed; then both ends of the ring are put through a hole in the back of the button, which can be made smaller if necessary, and a pin is then put through them, which secures them, and also allows the button to revolve. *Patent completed.*

439. G. H. GEYELIN. *An improved grate, whereby the perfect combustion of the various compounds of coal is produced.* Dated February 18, 1863.

This invention consists of a revolving grate with a single or double central partition, through which air is supplied to the fire and gases; one-half of the grate is covered in by a fixed plate. Whenever fresh coals are added to the front fire, the grate is made to revolve on its pivot, so as to bring the fresh coals under the fixed plate, where they are distilled, and the carburetted hydrogen gas (smoke) disengaged, which ignites in passing over the front fire. *Patent abandoned.*

440. M. SIEGRIST. *An improved atmospheric brake or break.* Dated February 18, 1863.

This invention consists in rendering rarified air or vacuum available as a brake power. *Patent abandoned.*

441. J. BARKER and E. MOSS. *Improvements in portable and stationary crabs or cranes.* Dated February 18, 1863.

This invention consists in placing the barrel and gearing and also the shafts and framework of a crab or crane upon a platform resting upon a circular conical support, fixed to a bed or foundation plate, so that the barrel and parts connected with it can be readily turned in any direction, without shifting the base, and afterwards held fast by a central bolt and nut. This part of the invention applies to both portable and stationary crabs and cranes; but when they are portable only, the inventors form slots in the base or foundation plate for holding a number of bars on each side, which can be drawn out for supporting weights when the crab or crane is in use, and pushed in when no additional weight is required. In both portable and stationary crabs or cranes, they make the brake-wheel of a V-shape instead of flat. *Patent abandoned.*

442. J. F. SPENCER. *Improvements in apparatus for regulating and working the valves of steam and other engines.* Dated February 18, 1863.

These improvements apply only to those cases where the valve or valves for regulating the admission or suppression of the steam is separate and distinct from the exhausting valve. In engines that have to be reversed the patentee attaches two distinct links placed side by side and connected together so as to form a double link to two eccentric rods worked by eccentrics on the crank or other shaft, so that one eccentric rod is attached to one end of the double link, and the other to the other end of the double link. The radius or connecting rod that is attached at one end to the exhaust valve or its rod or lever is attached at the other end to a sliding link in, say link 1 of the double link, and the radius or connecting rod that is attached at one end to the expansion or steam slide or its rod or lever is attached at the other end to a block sliding in, say, link 2 of the double link. If the eccentrics are set as usual—one for head and the other for back gear—and the double link is suspended in one position by moving the radius rod in link 1, the exhaust valves can be reversed, and by moving the other radius rod in link 2, the steam valves can be reversed, and the expansion can be varied without in any way affecting the efficiency or action of the exhausting valves. In stationary engines, or engines that do not require to be reversed, he uses two eccentrics and rods, and only one single link, and attaches the exhaust valve rod to one end of the link, the steam or expansion valve rod only sliding on the link to vary the cut-off. *Patent completed.*

443. J. H. BLY. *Improvements in cooking stoves.* Dated February 18, 1863.

This invention is not fully described apart from the drawings. *Patent completed.*

444. F. JOHSTON and R. HEATLEY. *Certain improvements in looms for weaving.* Dated February 18, 1863.

This invention is designed to dispense with the tappets and shaft now employed to actuate the healds, and the improvements consists in a novel arrangement and combination of apparatus by which the rise and fall of the healds are to be obtained, and which may be thus described:—Upon the inside surface of the front bottom or cross rail of the loom a bracket or support is fixed, carrying a pulley attached to a toothed pinion; this pulley is situated immediately under the healds, and the heald strap passes from one heald round the pulley to the other heald. Upon the back rail of the loom a lever or bar has its fulcrum or centre of radiation, the opposite end of such lever being toothed in the form of a quadrant, which gears into the aforesaid pinion. This lever is caused to move to and fro laterally by means of an undulating disc, and thus causes the semirotation of the pinion and pulley, and produces the rocking motion wich causes the rise and fall of the healds. A second part of the invention relates to the regulation of the tension of the warp, and consists in the employment and use of a rod or carrier to support the warp, which is supported by vertical rods, each terminating in a bowl or roller fitting into two hollows or cups formed on the aforesaid oscillating lever, so that, as the lever moves to and fro, the bowl rises out of one hollow and drops into the other, and then returns; thus, when the warp is slack, the elevation between the hollows causes its tension, and when the "shed" is open and less tension is required, the carrier or rod is at the lowest point; a bar is also employed upon the warp to give tension instead of the ordinary warp beam weights. *Patent abandoned.*

445. J. PLATT and W. RICHARDSON. *Improvements in machinery or apparatus for cleaning cotton from seeds.* Dated February 18, 1863.

This invention relates to that machinery for cleaning cotton from seeds known as the Macarthy gin, and has for its object the prevention of accidental breaking of the reciprocating blade or blades should they become clogged by an accumulation of material or otherwise unduly resisted. For this purpose, the inventors drive the said blade or blades through the medium of friction surfaces which will yield under the above-mentioned circumstances. Thus they mount a pulley loosely upon a shaft, which pulley is pressed forward by a spring, so as to cause it to force a disc of leather against a boss fast upon the said shaft, which also carries the cranks by which the blade or blades are caused to perform the reciprocating motion. The pulley above mentioned they use for driving the roller of the gin. When, therefore, an obstruction occurs, the friction surfaces will slip, and the action of the blade or blades will cease although the roller continue to revolve. *Patent abandoned.*

446. G. T. BOUSFIELD. *Improvements in breech-loading fire-arms.* Dated February 18, 1863.

This invention is not described apart from the drawings. *Patent completed.*

447. F. J. REED. *Improvements in apparatus for traversing guns.* (A communication.) Dated February 18, 1863.

This invention is carried out as follows:—Directly under the left rail of the chasses, and near the rear transom, is a shaft called the upper horizontal shaft; it is attached by and turns in two boxes or bearings affixed to the under surface of the left hand rail near the rear transom. Upon this shaft, directly outside of the rail, is a pinion, and upon the outer end of the shaft there is a cranked handle. Upon the outer and lower edge of the rear transom, directly under the the left hand rail, is a horizontal counter-shaft. This shaft is secured by two boxes or bearings to the rear transom. Upon the outer end of this shaft, and driven by the pinion before mentioned, is a cog wheel, and on the inner end of the shaft is a bevelled pinion which drives a large bevelled cog-wheel on an upright shaft, which turns in boxes or bearings fixed to the rear transom. Upon the lower end of the upright shaft is fixed a pinion which works into a circular toothed rack. *Patent completed.*

448. G. T. BOUSFIELD. *Improvements in the manufacture of boots and shoes, and in preparing india rubber for such and other uses.* (A communication.) Dated February 18, 1863.

The patentee claims—1, a leather boot or shoe having a vulcanized india-rubber sole sewed on in the manner described; 2, a leather boot or shoe having a vulcanized india-rubber sole secured with nails driven in from the outside and clenched; 3, a leather boot or shoes having a sole of vulcanized india rubber secured by wooden pegs driven through the sole, the upper leather, and the inner sole, as described; 4, a vulcanized india-rubber sole having a groove for the purpose described; 5, a vulcanized india-rubber counter or heel stiffener made as described; 6, the process described of preparing india-rubber rags so that they may be employed in the manufacture of soles for boots and shoes and other articles as described. *Patent completed.*

449. J. PUNTIS. *Improved appliances for displaying in the open air or indoors illuminated designs, devices, mottoes, or announcements, and in which jets of gas are employed as the illuminating agent.* Dated February 18, 1863.

This invention consists of an air-tight metal chamber of any shape, into which gas is admitted. This chamber is perforated with very fine holes on one or both sides, as occasion may require, and in any device or configuration for the purpose of illumination, and on the gas being admitted into the said chamber, the gas will pass through the said perforations, and when ignited the outside or perforated side or both sides, as the case may be, will clearly display the design. Outside the above-mentioned chamber the design or device can be painted in japan or distemper colours, or ornamented in any manner to suit the design of illumination, as circumstances may require or as fancy may dictate. *Patent completed.*

450. J. GRAY and J. HUDSON. *Improvements in the treatment of steatite, and in its application to certain purposes.* Dated February 18, 1863.

In carrying out this invention, the inventors take steatite, as extracted from its natural bed, and reduce it into pieces of small size, or by stamping or grinding disintegrate it and leave it in the condition of coarse powder. It is then put on to the hearth of a reverberatory furnace, and subjected to the action of heat. By this means the discolouration that is due to the presence of oxide of iron and other foreign matters is removed, and the material may be more or less bleached according to the duration of the process, and is then ready for subsequent use. They employ steatite thus prepared as a substitute for white lead in the manufacture of paints and such like articles of commerce. White steatite colours may be thus produced, and any variations of shade between white and brown may be obtained. *Patent abandoned.*

451. R. P. ROBERTS. *Improved axle-boxes for carriages or vehicles.* (A communication.) Dated February 19, 1863.

This invention consists in the method of securing the box in the hub or nave, which is accomplished by the use of a conical or wedge-shaped nut on the end of the box, which, when screwed up, operates both to wedge and clamp the box in the hub or nave. *Patent abandoned.*

452. T. MARKLAND and J. C. DICKINSON. *Certain improvements in machinery or apparatus for warping or beaming yarns and threads.* Dated February 19, 1863.

This invention is designed for the purpose of stopping the mechanism employed in the processes of warping and beaming when any of the threads become disunited; and the improvements consist in a novel adaptation, arrangement, and construction of apparatus for effecting the said purpose, and which may be described as follows:—Between the ordinary collars and warping beam a series of dents is arranged and secured in elastic material, so as to be contracted or expanded at requirement. These dents are employed to serve as guides for fingers or levers under which the yarn passes from the rollers to the beam, the said yarn on its progress passing underneath a cranked or bent portion of the said levers or yard guides, thus keeping them by the tension of the yarn in an elevated position; but as soon as one or more of the yarn threads become broken or disconnected, the levers or yarn guides resting upon such threads are released, and fall upon the frame holding the fulcra or centres of such levers and guides, thereby preventing or stopping a reciprocating rod in connection with the stopping motion of the machine from completing its action, causing an instantaneous stoppage to the whole machine. A faller shaft having a wire attached to a bell-crank lever passes underneath the whole series of guides, which, when the machine is stopped, raises such guides into position for the warp or yarn passing under them in their progress to the warping mill. *Patent completed.*

453. W. SHERWOOD. *An improvement or improvements in wine-glasses.* Dated February 19, 1863.

This invention consists in making wine-glasses by attaching bowls of glass to stems and feet made of metal. At the base of the bowl a peg or short stem of glass is formed, which is fixed in a screw socket by plaster of Paris or other cement. A foot and stem made of metal are connected with the bowl by means of a hollow screw on the top of the stem, into which the screw socket at the base of the bowl screws. *Patent abandoned.*

454. L. A. POUGET. *Improvements in the manufacture of oil lamps.* Dated February 19, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

455. R. PINKNEY. *Improvements in the manufacture of metallic pens.* Dated February 19, 1863.

This invention consists in the manufacture of pens, as substitutes for the ordinary steel and gold pens, of aluminium bronze. One of such alloys, of about 5 per cent. of aluminium to 95 of copper, possesses a fine gold colour. Another alloy, of 7½ per cent. of copper, possesses a greenish cold colour; and a third of such alloys consists of about 10 per cent. of aluminium to 90 per cent. of copper. *Patent abandoned.*

456. J. J. BADART. *Improvements in the preparation of cotton seed-cake.* Dated February 19, 1863.

Cakes of cotton-seed, obtained when pressing out the oil from cotton-seed, are now used for feeding cattle, but the cakes, after a few weeks, rapidly deteriorate on account of the cakes "heating." According to this invention, the patentee subjects the cakes, after they come from the press, to heat for some time, in order to dry them thoroughly; the cakes may then be stored and kept for a considerable time without any deterioration of their original fattening powers. He prefers to dry the cakes by placing them in a rack in a drying chamber heated to about 180 degs. Fahr. *Patent completed.*

457. W. TRUSTRUM. *Improvements in the manufacture of oiled silk.* Dated February 19, 1863.

The silk, after having been coated with oil in the usual manner is, according to this invention, finished by coating it with a solution of shellac, which the patentee prepares by dissolving the gum in water containing a little ammonia. He employs the following proportions:—3 lbs. of shellac, 1 gallon of water, and ½ lb. of ammonia. The solution of shellac is applied in a very diluted state, and several times, otherwise the film of shellac which the solution leaves on evaporating would not be of uniform thickness. *Patent completed.*

458. N. THOMPSON. *Improvements in apparatus for stopping bottles, jars, and other vessels, and in tools for producing parts of such apparatus.* Dated February 19, 1863.

This invention has reference to a previous patent, dated November 18, 1862, No. 3,100. According to this invention for stopping bottles and jars and other vessels, the neck of the vessel is made with a groove around it a short distance below the mouth, and the stopping apparatus (no part of which is permanently attached to the vessel) consists of a ring of sheet metal, with flanges projecting inwards from its upper and lower edges. This ring is divided into two parts, each of a semicircular form, which are hinged together on one side. To the upper flange of one of the half rings, a circular plate of the same diameter as the interior of the ring is soldered or attached, and in the centre of this plate is a hole, and immediately below it a screw nut is fixed; this receives a short screw, to the lower end of which a plate is connected in such a manner that the screw can turn independently of the plate. A disc or packing of cork or similar material is attached to the plate, and the top of the screw is made with a recess to receive a key by which it may be turned. When the stopping apparatus is placed on the neck of the vessel, and the two half-rings closed together, the flange at the lower edge of the ring enters the groove in the neck of the vessel all round at the same time; the plate at the lower end of the screw comes immediately over the mouth of the vessel, and the upper flange of the part of the ring which is not attached to the top plate comes over the edge of the plate so as to hold it down to the neck of the vessel; then, by turning the screw, the plate at its lower end with the packing upon it is forced down on to the top of the neck, and so closes fluid-tight the mouth of the vessel. *Patent completed.*

459. H. B. BARLOW. *Certain improvements in weaving, and in the machinery employed therein.* (A communication.) Dated February 20, 1863.

This invention is not described apart from the drawings. *Patent completed.*

460. W. MARSDEN. *Improvements in envelopes.* Dated February 20, 1863.

In carrying out this invention, the inventor forms spring locks of any suitable metal by means of dies and pressure, and folding and overlapping the same so that the slot is just above the recess in the front part of the lock to allow the tongue of the seal portion to pass into it with ease and facility, and occasionally through the lower portion thereof. *Patent abandoned.*

461. W. MARSDEN. *Improvements in buttons and other similar fastenings, and in the modes of attaching or securing the same.* Dated February 20, 1863.

This invention relates in part to certain improvements in the formation of buttons and other similar articles, whereby the same are rendered self-attaching, and in part to improvements in the media for fastening the ordinary buttons of commerce, and the like, to, in, or upon materials, to be thereby held together whether for wearing

apparel or other purposes. The object of the said invention in both cases is to dispense with the present tedious, constantly failing, and insecure mode or process of sewing on, by the substitution of an instantaneous, perfectly secure, and permanent fastening media, by which the buttons, &c., when once attached, will not come off, unless purposely removed, but can be also instantaneously detached when required. The said improvements consist, in the first place, in forming the said buttons, &c., with the shanks or tangs and other attaching media of the forms described integrally therewith; and in the second place in making the said attaching media apart from the said buttons, &c., and applying the same therewith, and also in adapting the same to buttons and other fastenings of the ordinary or other forms. *Patent completed.*

462. C. Billingsley. *Improvements in saddlery, harness, driving straps, and similar articles.* Dated February 20, 1863.

This invention relates to an improved fastener, intended as a substitute for the ordinary buckle. When a stirrup has to be suspended to a strap, band, or belt, the strap, band, or belt has at the end where it is to be fastened a number of holes for lengthening or shortening, and near the part where it is required to be fastened there is a clip of of leather or metal, and also a metal plate having one or more fixed or moveable studs projecting from it; the perforated end is passed through or round the stirrup, and then passed through the clip, and one or more of the holes are passed over the stud or studs on the fixed metal plate, a loop of leather being provided for retaining the end of the strap in its proper position. *Patent completed.*

463. J. Bentley and H. Booth. *Improvements in looms for weaving.* Dated February 20, 1863.

In the improved treading motion, each heald is attached to a jack or lever above and below in the usual way, but the patentees give motion to the jacks and healds in the following manner:—Each of the jacks at the opposite end to where it is attached to the heald is connected by a cord or wire to a T-shaped lever working on a stationary shaft or stud, and to each lever is jointed three other levers, one at the middle and one at each end. To the middle lever is fixed a bracket acted upon by a pattern chain; and the ends of the bracket, and also the end of the middle lever, are in contact with the other two levers, so that when the middle lever rises up and down, according to the pattern chain, it shall act upon the other two levers, and raise them up and down in order to bring one or the other in contact with a slide. When the top lever is acted upon by the slide, it gives one movement to the head, and when the bottom lever is acted upon the other movement is given to the heald, and the healds are brought back to close the shed by studs or rods fixed to the slide. *Patent completed.*

464. C. W. Siemens. *Improvements in insulating and supporting telegraph line wires.* Dated February 20, 1863.

The patentee claims—1, The employment of the juice or milk of the india-rubber and gutta-percha trees and varieties of the same for coating electric telegraph line wires or cables. 2, Effecting one or more coats of india rubber or gutta percha, either alternately or combined, upon electric line wires, by passing the wire to be so coated successively through a bath containing the juice or juices of the india-rubber and gutta-percha trees, and a shaft containing heated air or gases to consolidate or indurate the covering. Also the combination of such successive coats with layers or coats of insulating material applied in any known manner. 3, Effecting a tenacious covering to insulated telegraph line wire by saturating the fibrous material employed in forming the same with the juice or milk of the india-rubber or gutta-percha trees in the manner described. 4, The construction and use of posts or supports to electric telegraph line wires composed of a foundation plate of cast or wrought iron, or equivalent for the same, to which is attached by bolts or otherwise a pipe or socket of cast or wrought iron rising to some height above the ground, and receiving in its upper end a conical or cylindrical welded wrought-iron tube cemented into the same, and carrying the insulating supports for the line wire, substantially as described. 5, The construction of insulating supports for suspending the line wire or line wires from posts, as described. *Patent completed.*

465. W. Hainsworth. *Improvements in the manufacture of cast-iron pipes, columns, or any description of tubing.* Dated February 20, 1863.

This invention consists in forming the core bar solid or hollow of wrought or cast metal, or other suitable material, and of such a form in the cross section as to adapt it by being surrounded by green sand to form the core (thus dispensing with a baked core), and in combining with such core bar a core box in three or more parts, so that in making the core it is accessible the whole length. The core bar is provided with lugs in order to retain the green sand when rammed between them. The two top parts and bottom part of the core box are respectively formed so as to give the required curvature to the sand, one part of the box being left open, and the corresponding part of the curvature of the sand being produced by means of a "strickle" worked by hand. Air-holes are formed in the sand by means of bars or rods fixed in it and then withdrawn. *Patent abandoned.*

466. R. Bell. *Improvements in armour-plating or protecting ships and vessels.* Dated February 20, 1863.

This invention consists in securing to the iron frames or ribs double surface plates, that is, plates somewhat similar in form to ordinary rails for railways, the web or beam connecting the two surfaces being of a depth varying with the requirements of the ship. The inner surface of the plates is recessed, so as to receive between every two plates an intermediate and smaller but similarly shaped double-surfaced and webbed strengthening plate. Between every two plates where they are brought together on the outer surface, the patentee fits a rib or filling-up piece of teak or other suitable material, and for the purpose of tightening all the plates he makes an aperture through the web of all of them, and introduces in such aperture, in a heated state, a bolt or bolts so as to run vertically. He then passes a key through the bottom of the bolt, which, on cooling, tightens all the plates, and gives stability to the whole structure. He beds the inner surface of the plates on tarred felt or other like suitable material. In some cases he surrounds the vertical tie-bolt with a wooden washer or collar. At intervals he passes iron collars or clips, which run at right angles or nearly so to the vertical tie-bolts, round the vertical bolts, and keys the clips to the inner side of the frames or ribs of the vessel. *Patent completed.*

467. W. Clark. *An improvement in boilers for disintegrating and pulping vegetable substances.* (A communication.) Dated February 20, 1863.

The principal object of this improvement is to ensure the complete submergence of the substances in the liquor or solution during the boiling process; and to this end the boiler is made of an upright form, with a man-hole and man-head at the top, and with a perforated diaphragm or screen having a man-hole in its centre, corresponding with the first-mentioned man-hole, and communicating therewith by means of a perforated cylinder or well, and fitted with another man-head. The vegetable substances are confined below the diaphragm or screen, and the liquor or solution allowed to rise above it, thereby ensuring the submergence of the said substances. *Patent completed.*

468. W. Clark. *Improvements in projectiles for ordnance.* (A communication.) Dated February 20, 1863.

This invention relates to what are technically known as sub-calibre shot and shell, that is to say, shot and shell of a calibre less than that of the guns from which they are intended to be fired, and consists—1, in the combination of a bolt or elongated shell of iron or steel having a cutting face and a surrounding casing of wood or other light material; 2, in a rear cap of metal so applied in combination with the bolt or shell of the wooden casing as to serve as a means of holding the wooden casing, attaching the packing device, and guiding the rear end of the projectile in the bore of the gun; 3, in a front cap of metal so applied in combination with the bolt or shell and the wooden casing as to serve the purposes of holding the forward end of the said casing, of supporting and guiding the front end of the said casing in the bore of the gun, and of effecting the explosion of the charge of the shell by resistance against the surface of the body penetrated by the shell itself. *Patent completed.*

469. F. W. Bendorf. *Improvements in governors or apparatus for regulating the speed of steam engines or other engines for driving machinery.* Dated February 20, 1863.

For the purposes of this invention, the inventor employs a vibrating arm or instrument kept in motion by the steam or other engine, so that the number of vibrations of the arm or instrument corresponds with the number of revolutions of the engine. Together with this arm or instrument a pendulum is employed; it is of such a length as to swing in unison therewith when the engine is running at the speed required, whilst the vibrating arm or instrument and the pendulum are in unison. The throttle valve of the engine (or other apparatus serving a similar purpose) is not acted on; but directly the vibrating arm or instrument gets either in advance of or behind the pendulum, catches, previously held out of action by the pendulum, are allowed to act, and these cause the vibrating arm or instrument to drive the rod of the throttle valve or similar apparatus in one or other direction, according as it is required to make the engine go a ster or slower. *Patent abandoned.*

470. W. Husband and J. Quick. *Improvements in apparatus for raising sewage and water.* Dated February 20 1863.

This invention consists of improved apparatus for the purpose of raising the sewage and water from one level to another in pipes, and for securing a continuous flow of sewage and water along a tube or pipe, the apparatus effecting these objects with all the advantages of a pump, and yet requiring no valves. The inventor proposes to apply the apparatus to the elbow of a tube or pipe of a curve representing the segment of a circle of any required radius, the tube forming a portion of the said apparatus and being cut with a slot in its interior pheriphery in order to permit of the passage of the arms or spokes of a wheel or of a disc within such slot. He proposes to set a wheel or a disc upon an axle which works in bearings or journals fixed on standards, the centre of the axle being concentric with that of the segmental tube; the arms of the wheel are, or the disc is, of such diameter as to enter the tube by passing within the slot, and the said arms are, or the disc is, provided with pistons packed or otherwise to fit the interior of the tube. There may be any desired number of pistons attached according to the dimensions of the apparatus. Power is applied to cause the wheel or disc to rotate, and the slot is packed with an elastic packing to close together immediately after the passage of the arms (when a wheel is used) or to press on each side of the disc (when a disc is used); or it is packed with strips of leather or other material, closing on the disc by the pressure of water within the tube. *Patent abandoned.*

471. C. Malpas. *Improvements in ovens or kilns for firing, burning, or baking pottery, bricks, tiles, and other earthenware or ceramic articles.* Dated February 21, 1863.

The patentee claims—1, The construction and employment of annular ovens or kilns, with revolving beds for baking, burning, or firing pottery ware and earthern or ceramic articles, having one or more external furnaces; and diametrically opposite these, or at some distance from the same, one or more openings for filling in and removing the goods to be fired, and in which ovens or kilns the draught from the furnace or furnaces passes directly underneath the objects to be fired, and thence vertically up among the same into one or more flues formed over or near the roof of the oven or kiln. Also, in combination with the above, the arrangement of flues lining a certain portion or the walls of the oven or kiln for gradually raising the temperature of the articles to be fired before they reach the furnaces, substantially as set forth. 2, The construction and employment of a chamber serving as a mustering, drying, and placing room, formed on the top of annular ovens or kilns with rotating beds, so as to utilize the spare heat therefrom. 3, The patentee claims, in combination, the arrangement of the several parts of annular ovens or kilns with rotating beds, as described. *Patent completed.*

472. R. Thompson. *Improvements in apparatus for moulding.* Dated February 21, 1863.

This invention is particularly applicable for moulding socket pipes to be cast on end with the socket downwards, but it may be applied in moulding other articles. When the invention is applied in moulding socket pipes of large dimensions, the core barrel is made in two parts, connected by a taper joint, the larger diameter for the interior of the socket being attached to or cast with the body of the truck usually employed for facilitating the transport of the mould into and out of the drying stove. The moulding box is or may be made in two parts; the lower portion containing the socket is connected to the truck and to the plain portion for the body of the pipe by studs and pins. The large portion of the core is made by means of a strickle board, and the remainder of the core is made in the usual manner. In moulding the pipe, the larger portion of the pattern is fixed to a separate truck, and the sand is rammed into the lower portion of the box; a short cylinder as now customary is employed for moulding the remainder of the pipe. *Patent abandoned.*

473. H. Kilshaw and T. Elce. *Certain improvements in machinery for preparing and doubling cotton and other fibrous substances.* Dated February 21, 1863.

This invention is not described apart from the drawings. *Patent completed.*

474. F. J. Manceaux. *Improvements in firearms, or in transforming arms of large calibre into arms of smaller calibre.* Dated February 21, 1863.

This invention consists, as hereafter set forth, in means of transforming small arms of large calibre, and muzzle-loading, into arms of smaller or reduced calibre, and either muzzle or breech-loading, preserving all the parts used in the first manufacture of the gun without any other change than that of the barrel. The patentee first cuts out bars or strips of walnut or other wood, similar to that of the stock of the arm in which a barrel of smaller calibre is to be substituted for the original and larger barrel, and rounds, shapes, and adjusts them in the channel or groove in the stock for the reception of the barrel of reduced calibre, so that they may exactly fill the place or channel occupied by the original barrel. He gently heats the fore part of the stock and the wood filling piece or pieces separately, and applies hot clear glue to the surfaces of both. He then adjusts the filling piece or pieces in the channel, and keeps them in close contact by bands wound round them by clasps or otherwise, and dries the glue under gentle heat. When thoroughly set, he cuts out of, or in, the filling a channel for the reception of a barrel of less calibre than that removed. He then heats to redness thereduced calibre barrel, and adjusts it in the channel so that it may bear on the bottom thereof, and so that the nipple on the new barrel may present itself directly under the head of the hammer of the lock. He then passes the breech screw through the tail of the barrel, and into the stock. The buckles and rings used for fastening the old barrel in the stock may be used for the barrel of smaller calibre; but in order to adapt them to this barrel he lines them with iron to make up for the difference in the calibre. To complete the adaptation of all the accessories of the larger to the smaller barrel, he lines the socket of the bayonet with iron or steel; and instead of the barrel of the smaller calibre being muzzle-loading, it may be breech-loading, in which case the channel will have to be carried further back in the stock. *Patent completed.*

475. E. T. Hughes. *Improvements in the treatment of colouring matters derived from tar for the purpose of making them applicable for painting.* (A communication.) Dated February 21, 1863.

For obtaining cakes of red, blue, and violet, the inventor takes 15 grammes of white soap, and dissolves it in 100 grammes of hot water, and then mixes with the solution 6 decigrammes of colour previously dissolved in methylitic alcohol, or other solvent. To this mixture he adds 25 grammes of pure alumina in a gelatinous state, and then filters and dries the mixture. These proportions may be varied at discretion; for instead of 6 decigrammes of colour, a large quantity may be used in order to have a greater depth of colour. Instead of the white soap, glycerine and soaps made from oils or grease derived from animal matters may be employed; and instead of the alumina, sulphate of barytes or other metallic or earthy oxide may be used, and thus obtain the means of manufacturing all the colours derived from tar into cakes or pigments. Thus, the colour is dissolved in any of the known solvents, and then mixed in a water bath with vegetable or animal soaps dissolved in the hot or cold state, and precipitating the colour by alumina previously precipitated from alum or sulphate of barytes, or any other kind or salt or metallic or earthy oxide. By these means, and especially by the assistance of an animal matter in a soapy state, the colours are rendered solid and durable, and are applicable for painting. *Patent completed.*

476. R. V. Dodwell. *An improved method of preventing the destruction of plants by insects and certain descriptions of animals, and in the means for effecting the same.* Dated February 21, 1863.

This invention consists in the application, adaptation, or employment of galvanic or electrical influence or agency for the destruction of insects, &c. The plants to be protected are to be surrounded by a galvanic arrangement of metals, either separately if large, or, if the plants are small, the bed containing them is to be surrounded, say, for instance, with an edging or border of zinc having a band of copper soldered or attached upon its surface, whereby a galvanic action is set up, and which will be found to effectually prevent the passage of insects or animals, for, though the action may be but slight, it excites in a sufficient degree to prevent them crossing it. Galvanic com-

binations of other metals may be employed. *Patent abandoned.*

477. A. H. Remond. *Improvements in preserving provisions, and in the apparatus employed for such purpose.* Dated February 21, 1863.

The first part of this invention consists in causing a current of electric fluid to pass through the cases containing the provisions after they are finally closed up; such electric fluid being made to pass along a fine iron or other metallic wire through the case, causes the wire to become red-hot and consume the oxygen. Another improvement consists in placing inside the case, and in connection with the thin wire, any known chemical agent (such as common sulphur, for instance) which, in its ordinary state, has no particular affinity for oxygen, but which, upon becoming ignited (by means of the electric wire above referred to) evolves any gas (sulphuric acid gas, for instance) which will absorb, destroy, or convert into a harmless gas the oxygen which is contained in the case, and which it is desired to get rid of; or the sulphur or other agent may be ignited by any other convenient means. A further improvement is as follows:—After the can has been closed, a sufficient quantity of hydrogen gas is to be introduced therein to form (with the oxygen which may be in the case) an explosive mixture or gas, and this gas is to be then ignited by passing a current of electricity along a metal wire through the same, and thus all traces of oxygen will be destroyed. *Patent abandoned.*

478. A. Ceileur. *Improvements in apparatus for taking photographic impressions or likenesses by means of the camera.* Dated February 21, 1863.

This apparatus consists of an arrangement of parts for holding the negative plate in camera obscuras, while taking the impression thereon by means of the lens, in such manner that the plate can be moved laterally and also vertically for the purpose of changing its position and presenting a new surface to receive an impression. *Patent abandoned.*

479. W. Wood. *Improvements in the process of manufacturing pomfret or liquorice cakes, rolls, sticks, and pipes, and other similar articles of confectionery.* Dated February 21, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

480. H. Mackinder. *Improvements in apparatus for separating potatoes into different sizes.* Dated February 21, 1863.

The potatoes which are to be sorted into different sizes are placed in a hopper, from which they descend on to an inclined riddle. The parallel wires or rods of which this riddle is formed are set at such a distance apart as to allow only the smallest potatoes and the dirt to drop through. After passing over this riddle, the potatoes reach a second riddle of similar construction, but with the parallel wires or rods further apart, so as to allow potatoes suitable for seed to pass. These two riddles are combined together in a moveable frame carried by small wheels which rest upon short guide rails on the main frame of the apparatus, and the riddle frame receives a to-and-fro motion from a connecting rod and a crank on an axis which is driven by a band passing around a pulley on the crank axis, and also around another pulley which is driven directly by a crank handle. A fly-wheel is employed to render the motion more regular. The motion thus communicated to the riddles serves both to keep the potatoes in movement, and also to clear from the spaces of the screen any potatoes which may be set fast between them. There are for this purpose, immediately underneath the riddles, rollers passing from one side to the other of the fixed frame. These rollers are able to turn freely, but in other respects they are held stationary, and the riddles pass backwards and forwards over them, so that whenever a potato passes partly through the riddle, and then becomes fast, it is pushed back again by coming against one of the rollers, and thus the riddles are kept clear. *Patent completed.*

481. J. Brown. *Improvements in the manufacture of armour-plates for ships and other structures.* (A communication.) Dated February 21, 1863.

For the purposes of this invention, plates of wrought iron are piled one on the other having between them crushed or pulverized Franklinite Spiegal iron or similar metal. This pile is heated to a suitable degree to cause the Franklinite Spiegel iron or other metal to assume a pasty or melted state, and the wrought-iron plates to be brought to about a welding heat, so that, when rolled or pressed, the parts of the pile will combine. The rolling is to be continued till the mass is reduced into a plate of any desired thickness. A series of such compound plates are piled one on the other with pulverized Franklinite Spiegel iron or other like metal between them, and this pile is to be heated and rolled or pressed and reduced to the desired thickness either for an armour-plate or for being again piled with other plates as above explained. Fluxes may be used when found desirable. *Patent completed.*

482. A. Dugdale. *Improvements in throttle valves.* Dated February 21, 1863.

The patentee claims mounting and causing the valves to turn upon a shaft independent of the actuating parts, these latter being connected inside the steam-pipe by jointed rods, toothed sectors, or other mechanical equivalents, connected to one extremity of the valve, so that the shaft shall serve merely as a hinge or pivot for the valve. *Patent completed.*

483. W. E. Newton. *Improvements in the construction of wind instruments of music.* (A communication.) Dated February 21, 1863.

This invention relates principally to that kind of wind instrument in which valves or pistons are employed for modifying or assisting in producing the notes or tones. One of the objects of the invention is to facilitate a change of key, and another is to construct the instrument in such a manner that it can be carried more easily by the player. In order to effect the first object, the instrument is divided into two main parts, which are connected together by a central pivot on which one part may be turned horizontally on the other in either direction for a short distance. The upper part of the instrument carries the principal working parts, and the lower part consists mainly of the lower bends of the main tubes. In order to admit of changing the key of the instrument, there are several additional tubes, so that the main tube may be lengthened or shortened as may be desired. These additional tubes all terminate at the central part of the instrument, where the top and bottom parts are connected. These tubes are adapted to a perforated valve-plate, in which there are as many ways as there are sections of the main tubes in the lower half of the instrument. This valve-plate, with the tubes thereon, turns on the central pivot, so as to bring any section of the lower part of the main tube into coincidence with the upper part. A change of key may therefore be produced by simply moving the valve-plate round horizontally part of a circle. In order to render the instrument more convenient to carry, the bell part of the main tube is bent back, and passed either over the left shoulder or under the arm-pit. *Patent abandoned.*

485. W. H. Gauntlett. *Improvements in apparatus for heating the blast in the manufacture of iron.* Dated February 23, 1863.

This invention has for its object the more effectually heating the pipes before passing into the blast furnace in the smelting of iron ores, and is applicable either with the ordinary fuel, or with the waste gases generated in the furnaces. The patentee constructs a double stove with internal pipes having a division wall separating it into two single and distinct stoves, each having a separate fire grate or combustion chamber. There is an aperture in the division wall which is opened or closed by any convenient means. He makes the heating pipes with portions of their substance to project from the internal surface, or the internal surface may be corrugated. He also puts studs across the interior of the pipes from side to side. These projections, studs, or corrugated surfaces will have the effect of splitting up or disturbing the blast, and preventing it from passing through the the pipes in a body, and will consequently cause the heat to be more intimately conveyed to the air which it is intended to heat. He prefers to place a pair of these stoves opposite each tuyere house of the furnace, so as to deliver the blast direct or nearly so to the tuyeres. The two outlet pipes form a pair of stoves, having previously been allowed to converge into one pipe, by preference outside such pair of stoves. *Patent completed.*

486. E. T. Hughes. *Improvements in the process of cleaning organic matter.* (A communication.) Dated February 23, 1863.

This invention consists in the treatment of organic matter, more particularly wool and other fibrous materials charged with fatty and oleaginous or resinous substances, whereby the inventor separates the said fatty, oleaginous, or resinous substances from such fibrous or other matter. For this purpose, he places the organic matter in a vessel, where it may be subjected to pressure, and then forces through it, by means of a pump, or by hydrostatic pressure, a current of bisulphuret of carbon, or other volatile hydro-carbons, which dissolve the greasy substances and carry them off with it into a separate receiver, where, by means of heat, he separates the one from the other, and, subsequently, in order to free the organic matter from the volatile oil which may have been absorbed in the mass, he causes it to be traversed by a current of heated air put in motion by a force-pump or ordinary fan. *Patent abandoned.*

487. J. Eckersley. *Improvements in spinning and doubling silk.* Dated February 23, 1863.

This invention has for its object the spinning and doubling of the threads of the silk-worm direct from the cocoons. To accomplish this, the inventor prepares the cocoons in the ordinary manner, and then places them in a vessel or vessels containing hot water, the said water being maintained at or near a constant temperature by the aid of steam. The thread or threads of the cocoon or cocoons are passed over a hook or through an eye, and then pass between two rollers, and over the top roller and round a pin and between the said rollers again, but in an opposite direction to that before named. The thread now passes to an ordinary flyer, and it is wound on a bobbin placed on a spindle driven by a band or cord. The amount of twist is regulated by the velocity of the top roller, as compared with the velocity of the spindle. A traversing rail is used for traversing threads upon the bobbins. The object of spinning, as herein given, is to produce a more uniform thread with less labour than at present in use. The process known as doubling is accomplished by placing the threads of two or more of the before-named bobbins in such a position that they may pass through the eye or over the hook before named, and be spun or twisted together in a similar manner to that before named, and wound on other bobbins placed on the before-named spindles from which the first-named bobbins have been removed. *Patent abandoned.*

488. R. A. Brooman. *Improvements in dressing millstones, in ornamenting or engraving on glass, pottery, and other similar substances, and in materials employed therein.* (A communication.) Dated February 23, 1863.

This invention consists in dressing millstones, and in ornamenting glass, pottery, and other similar substances, by the action of hydro-fluoric acid on the silicious matter of which they are more or less composed. *Patent completed.*

489. J. B. E. Daticht. *Improvements in steam-engines.* Dated February 23, 1863.

This invention consists in utilizing the steam after it has produced its effect in the cylinders of steam-engines by passing it into and through condensing apparatus consisting of tubes surrounded by water alone, air alone, or by air and water, the air being forced in by a fan or blast, and the water, when water is used, being allowed to trickle down the outside of the tubes in a case surrounding the same, which water rises, overflows, and enters a double casing, escapes therefrom, and is returned to the supply cistern. The steam being more or less condensed, is forced by suitable pumps into the boiler directly, or through a coil in or round the casing of the boiler, whereby it becomes heated before entering the boiler. The condensers consist of jacketed cylinders containing within them another casing in which are tubes, into which tubes the waste steam from the cylinders is made to enter; or the patentee reverses the position of the steam and of the air and water, or air or water—that is to say, he causes the air and water, or air alone, or water alone, to pass through tubes contained in a casing or cylinder into which the steam to be condensed is admitted. *Patent completed.*

490. J. D. and A. P. Welch. *Improvements in machinery for blocking and pressing hats and bonnets.* Dated February 23, 1863.

This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated May 8, 1863.

1158. C. F. Bielefeld. Improvements in the manufacture of sheets, slabs, and other articles where fibrous materials are employed.

Dated August 14, 1863.

2007. A. E. Brae, Leeds. Improved means of conducting electric currents through railway trains, and of actuating signals or alarums therein.

Dated August 15, 1863.

2023. E. Scott, engineer. Certain improvements in apparatus for governing or regulating the speed of engines. (A communication.)

Dated August 20, 1863.

2065. G. Spencer, 6, Cannon-street West, civil engineer. Improved solutions to be used in the manufacture of paints and the preservation of wood, stone, and metallic surfaces, and in the preservation and waterproofing of fibrous materials generally, and for other purposes. (A communication.)

2068. W. Hamilton, 45, Ship-street, Brighton, upholsterer. Improvements in the manufacture of spring mattresses.

Dated August 21, 1863.

2076. T. F. Cashin, civil engineer, Sheffield. Improved means of communication between the passengers, guard, and driver of a railway train in motion.

Dated August 25, 1863.

2101. W. E. Gedge, 11, Wellington-street, Strand. Improvements in machinery or apparatus to be used in the manufacture of handles. (A communication.)

Dated August 27, 1863.

2115. T. Bourne, New York. Improved method of storing and holding petroleum and other oils, naphtha, and other products of distillation containing essential oils. (A communication.)

2116. F. Pragst, Moscow and Manchester, engineer. Certain improvements in steam engines and in the mode of utilizing steam.

2117. J. Clark, Glasgow. Certain improvements in break blocks for railway and other carriages, and in the means of applying the same.

Dated August 28, 1863.

2123. R. Bell, Glasgow, manufacturer. Improved measuring apparatus for looms.

2125. E. Vickers, Sheffield, manufacturer. Improvements in the manufacture of steel.

2129. C. Harratt, Hornsey-lane, Highgate. Improvements in apparatus for tilling land.

Dated August 29, 1863.

2131. H. C. Pennell, Weybridge, Surrey, gentleman. Improvements in the construction of skates.

2132. H. W. Putnam, New York, manufacturer. Improved machine for wringing clothes.

2133. G. Lowry, Stanley Steel Works, Salford, machine maker. Improvements in, and applicable to, cotton gins.

2135. W. Tingey, Manchester. Improvements in printing carpets, piled fabrics, druggets, and other similar articles.

2136. T. Williams, Manchester, cotton spinner. Improvements in machinery or apparatus for steaming and opening cotton and other fibrous materials.

2139. A. Agnew, Welshpool, Montgomery, gunmaker. Improvements in breech-loading firearms.

2141. W. Weldon, 3, Falcon-court, Fleet-street, publisher. Improvements in apparatus for aërial navigation.

2143. J. Dodge, Waterford, Saratoga, New York, mechanical engineer. Improvements in machinery or apparatus for grinding and polishing metallic articles.

Dated August 31, 1863.

2147. F. A. Braendlin, Birmingham, mechanical engineer. Improvements in breech-loading firearms.

2149. B. L. Burnett, Teignmouth, wine merchant. Improved arrangements for removing the fuel from stoves or grates, and for facilitating the extinguishing of the fires used therein.

2153. J. Miles, Hastings, Sussex, cutler. Improvements in traps for catching rats and mice, rabbits, and other animals and birds.

2155. M. J. Roberts, Pendarron-house, near Crickhowell, esquire. Improvements in the arrangements or fitting of axles for railway and other carriages.

Dated September 1, 1863.

2156. J. Snider, jun., Dorset-street, merchant. Improvements in breech-loading and other ordnance, part of which is applicable to the utilizing of old smooth-bore cannon, and in projectiles to be used therewith.

2157. C. Shorrock, manufacturer, and W. Shorrock, manager, Over Darwen. Certain improvements in looms for weaving.

2158. G. Russell, Glasgow, engineer. Improvements in apparatus for cooking, and for obtaining fresh water for use on shipboard and otherwise.

2159. W. Clark, 53, Chancery-lane, engineer. Improvements in hydraulic apparatus. (A communication.)

2163. T. Erich, 77, Newgate-street. Improvements in machinery for pressing peat. (A communication.)

Dated September 3, 1863.

2176. W. Boulton, iron founder, and J. Worthington, engineer, Burslem. An improved method of making and inlaying encaustic tiles or other plastic articles and substances.

2178. W. and T. Jolliffe, steamboat owners, W. Graham, ship's joiner, and H. Taylor, ship's joiner, Liverpool. Improvements applicable to paddle and other propelling wheels, for navigable vessels.

2182. J. Loebl and I. Pick, Scott's-yard, Bush-lane, merchants. Improvements in fastening gloves.

Dated September 4, 1863.

2186. T. Fisher, 7, Remington-street, City-road. Improvements in spring balances where spiral springs are used.

2188. G. Hargreaves, Shipley, Bradford, York, worsted spinner and manufacturer. Improvements in steam boilers.

Dated September 5, 1863.

2190. W. Norton, Holley Bank, near Arva, Cavan, gentleman. Improvements in laying and supporting submarine telegraph cables.

2194. R. Batt, Waterhouse Mill, Milnthorpe, Westmoreland, paper manufacturer. Improvements in paper-making machinery.

2196. G. B. Rennie, Holland-street, Blackfriars, engineer. Improvements in the construction of floating docks and pontoons, and the means of cleaning, painting, or repairing them.

Dated September 7, 1863.

2200. H. Twelvetrees, Bromley, manufacturer. Improvements in portable mangling and wringing apparatus.

2202. S. Gerish, 60, Shoe-lane, Holborn, and J. Weston, 80, Whitecross-street, St. Luke's. Improvements in machinery for mortising, drilling, dovetailing, and cutting wood, and in tools to be used for mortising.

Dated September 8, 1863.

2204. J. H. Cutler, Birmingham, manufacturer. A new or improved dress fastening, which said fastening is also applicable to the fastening of bands and belts and to other like purposes.

2206. W. A. Wilson, Liverpool, engineer, and J. Smith, Liverpool, baker. Improvements in furnace firegrates.

2210. W. Hewitt, Bristol, engineer. An improved rudder, and means of working the same.

Dated September 9, 1863.

2216. T. Naden, Birmingham, architect. Improvements in raising the covers or lids of hot water jugs, tea-pots, coffee-pots, and other vessels.

2220. E. T. Hughes, 123, Chancery-lane. Improvements in the manufacture of chenille, and in the machinery or apparatus employed therein. (A communication.)

2222. W. Clark, 53, Chancery-lane, engineer. Improvements in the means of utilizing refuse azoted matters of commerce for the manufacture of various chemical products. (A communication.)

2224. G. T. Bousfield, Loughborough-park, Brixton. Improvements in rollers to be used in machinery for spinning and manufacturing wool, cotton, and other fibrous materials. (A communication.)

2226. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improvement in steam engines. (A communication.)

2228. E. Olliver, engineer, and G. Myers, draughtsman. Improvements in apparatus for lowering and disengaging boats from vessels.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, September 22, 1863.

1158. C. F. Bielefeld. Manufacture of sheets, slabs, and other articles when fibrous materials are employed.

1173. C. H. G. Williams. Manufacture of colouring matters.

1178. R. Burgess. Marking, etching, or engraving cylindrical and other surfaces.

1183. R. A. Brooman. Coupling and disconnecting carriages on railways. (A communication.)

1184. J. S. Guirette. Inhaling apparatus.

1186. J. E. McConnell and G. H. Bovill. Chains for cables.

1191. J. E. McConnell and G. H. Bovill. Treating worn-out railway tyres.

1193. G. A. Huddart. Cutting slate.

1195. R. A. Brooman. Spring mattresses. (A communication.)

1199. R. A. Brooman. Laying submarine telegraph cables. (A communication.)

1201. T. Parkinson and F. Taylor. Weaving, sizing, dressing, and dyeing.

1203. J. E. McConnell and G. H. Bovill. Manufacture of thick plates of wrought iron for armour plates and other purposes.

1206. B. Lambert. Paper-makers' rag or pulp engines.

1208. J. Farmer. Calendering, embossing, and other such machines used for finishing woven fabrics.

1209. R. A. Brooman. Extraction of hydro-carburets from minerals. (A communication.)

1219. I. Parker. Connecting and securing door and other knobs or handles to their spindles.

1222. D. M. Fyfe. Raising, removing, transporting, and refixing military or other targets or mantlets.

1225. R. T. Mallet. Construction of piers, walls, and other similar structures.

1228. J. Patterson. Grinding, crushing, cleaning, and hulling or shelling various kinds of farm or vegetable produce.

1230. J. Hinks. Lamps.

1235. J. Gibbs. Preparing and spinning flax and other vegetable fibres and filaments.

1241. W. Watson. Manufacture of bread.

1245. R. Fenner and W. H. Hight. Envelope folding machines.

1250. J. Edwards. Permanent way.

1258. T. P. Salt. Manufacture of trusses.

1301. R. A. Brooman. Indicating the position of trains upon railways. (A communication.)

1337. C. T. Boutet. Measuring distances and altitudes.

1362. W. Clark. Manufacture of manure. (A communication.)

1365. W. Clark. Apparatus for printing fabrics, papers, and other surfaces in colours. (A communication.)

1782. H. Elliott. Breech-loading firearms.

1836. C. Beslay. Making all woven and thready fabrics waterproof, and in finishing or surfacing fabrics generally. (A communication.)

1975. E. Myers and H. Forbes. Rotary pump.

2044. J. Broadley. Means or apparatus employed in weaving.

2108. T. Westhorp. Preparing out rope strands or yarns for carding into oakum.

2128. J. Alison. Tilling land.

2132. H. W. Putnam. Wringing clothes.

2138. D. Spiers, A. Boyd, and J. Kirkwood. Looms for weaving.

2226. A. V. Newton. Steam engines. (A communication.)

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed September 18, 1863.

735. E. Lever.
736. H. Wilde.
740. C. Webster and W. Forgie.
745. J. and T. A. Nield.
746. R. A. Brooman.
750. C. Pryse and D. Kirkwood.
752. F. de Wylde.
754. F. and A. Roberts.
756. G. A. Biddell.
757. E. Hartley, T. and J. Mellodew.
758. J. M. Hetherington.
764. W. Johnston.
769. J. Reilly and W. Martin.
780. G. Stuart.
781. C. Monson.
782. R. Armitage and C. Senior.
793. R. A. Brooman.
787. L. Christofleau.
789. G. Cowdery.
792. W. Johnson.
801. J. Grantham.
802. W. M. Morgan.
804. J. Taylor.
811. J. Leeming and R. S. Markindale.
816. J. Musgrave.
818. R. Mushet.
821. W. E. Newton.
839. W. Clark.
848. D. S. Sutherland.
884. J. Mosheimer.
905. G. Colomb.
952. A. V. Newton.
1010. W. E. Newton.
1040. A. Legras.
1064. W. Clark.
1223. W. Clark.
1262. J. Coignard.
1339. C. E. Laederich.
1616. W. B. and J. Bradshaw.
1619. G. Davies.
1693. W. Basford.
1738. A. Moutleart and W. Tent.
1828. J. E. Vanner.
1844. G. Davies.
1862. W. Tranter.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2243. J. Horsey.
2249. S. Barnwell and A. Rollason.
2257. G. F. Smith.
2260. W. E. Newton.
2264. H. Stead and H. Gledhill.
2271. G. Owen.
2282. T. Greenwood.
2290. V. H. Laurent.
2292. J. and J. Cash.
2295. T. Westhorp.
2298. R. Mushet.
2306. H. E. Skinner and W. H. Miller.
2326. J. Haworth.
2365. R. Mushet.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2159. S. Chodzko.
2202. W. Young.
2294. J. Holman.
2251. J. J. Russell and J. B. Howell.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending September 19, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
160	0 4	311	0 4	321	0 4	332	0 4	341	0 4	350	0 4
286	0 8	312	0 10	322	0 4	333	0 4	342	0 4	351	0 4
288	1 2	313	0 6	323	0 4	334	1 2	343	0 4	353	0 4
304	0 8	314	1 10	324	0 8	335	0 4	344	0 4	354	0 10
305	0 8	315	0 8	325	0 10	336	0 4	345	0 8	355	0 4
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307	0 10	317	0 4	328	0 8	338	0 4	347	1 0	358	0 10
308	0 8	318	0 6	329	0 4	339	0 10	348	0 4	359	0 4
309	0 4	319	0 4	330	1 8	340	0 4	349	0 4	360	0 4
310	0 10	320	0 4	331	0 10						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	p. ct.
IRON:—					
Welsh Bars, in London	per ton	7 10 0	to	8 10 0	2½
Nail Rods	do	8 0 0		9 15 0	
Hoops	do	9 0 0		9 10 0	
Sheets, single	do	10 0 0		10 10 0	
Staffordshire Bars	do	8 10 0		8 15 0	
Bars, in Wales	do	6 10 0		0 0 0	
Rails	do	6 15 0		0 0 0	nett
Foundry Pigs, at Glasg. No 1	do	2 19 0		3 6 0	
Swedish Bars	do	11 10 0		12 0 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		16 15 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	102 0 0		0 0 0	
Hammered Bottoms	do	112 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	107 0 0		0 0 0	
Tough Cake and Ingot	do	93 0 0		0 0 0	
Tile Copper	do	93 0 0		0 0 0	
Best Selected	do	98 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8¼		0 0 8½	
Fine Foreign	per ton	98 0 0		100 0 0	
TIN:—					
English Block	per cwt.	5 15 0		0 0 0	2½
do Bar	do	5 16 0		0 0 0	
do Refined	do	6 0 0		0 0 0	
Banca	do	6 3 0		0 0 0	
Straits	do	5 18 0		5 18 6	
TIN PLATES:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 0	
Second Quality	do	1 7 0		1 7 0	
Coke	do	1 3 0		1 4 0	
LEAD:—					
Pig, English	per ton	21 7 6		21 10 0	
„ Spanish Soft	do	19 7 6		19 10 0	
Shot, Patent	do	23 10 0		0 0 0	
Sheet	do	21 0 0		0 0 0	
White	do	27 0 0		27 10 0	
SPELTER:—					
On the spot	do	18 15 0		0 0 0	nett
ZINC:—					
English Sheet	do	23 0 0		24 0 0	2½
QUICKSILVER	per btl.	7 0 0		0 0 0	3
REGULUS OF ANTIMONY:—					
French star	per ton	38 0 0		0 0 0	

TIMBER, duty 1s. per load, drawback 1s.

	£ s.	£ s.		£ s.	£ s.
Teak ... load	£12 0	£13 0	Archangel, yellow	£13 0	13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
„ yellow pine	3 10	4 10	Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0	Memel	10 0	13 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
„ birch	3 10	4 10	„ white	9 0	9 10
„ elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderhamn	9 10	10 10
„ fir	2 10	3 10	Christiania, per C., 12 ft. by 3 by 9 in.		
Memel fir	3 5	3 10			
Riga	3 0	3 5	Christiania, yellow	21 0	23 0
Swedish	2 10	2 15	Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 1
Masts, Quebec red pine	5 0	6 0			
„ yellow pine	5 0	6 0	PUMICE STONE pr ton	6 10	9 0
Lathwood, Dantzic, fm	5 10	6 10	OILS, &c.		
„ St. Petersburg	8 0	8 10	Seal, pale ... per tun	46 0	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Sperm body	80 0	0 0
			Cod	65 0	66 0
			Whale, Sth Sea, pale	42 10	43 0
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	60 0	0 0
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	47 0	0 0
Yellow pine, per reduced C.			Palm, fine	36 0	37 0
			Linseed	43 6	0 0
Canada, 1st qual.	17 0	18 0	Rapeseed, Eng. pale	44 10	0 0
„ 2nd do.	11 0	12 0	Cottonseed	30 0	34 0

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THE MECHANICS' MAGAZINE.

Contents of the Last Number:— PAGE

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 2, 1868.

STEAM PLOUGHING.

Notwithstanding a very considerable expenditure of capital by men of talent and experience, steam cultivation makes but slow progress. In certain cases, horses have been sold, fences removed, roads constructed, and fields levelled, to make way for the steam plough; and from the farms where this course has been adopted, the most favourable reports are constantly laid before the public. A few hundred instances of the kind, however, really prove very little; and the practical introduction of the steam plough as an habitual implement with our farmers, is undoubtedly still very far off. This is the more remarkable, inasmuch as steam cultivation is not a thing of yesterday. The requisite machinery has been brought so near the limit of perfection, that the work accomplished by it, on heavy soils especially, is all that the farmer can desire; while its management may be safely entrusted, after a little preparatory training, to such men as may be met with in every agricultural district in Great Britain. Steam tillage benefits the land, enables larger crops of better quality to be grown, and renders the agriculturist, to a certain extent, independent of the vicissitudes of the weather in spring and autumn. As far as the quality of the work done is a criterion of excellence, that performed by steam is pronounced the best possible, almost without a dissentient voice. Yet steam ploughing makes slow progress into favour with the English farmer, simply because these valuable results have been hitherto obtained under exceptional circumstances, only to be secured under conditions which agriculturists, as a body, are not prepared to meet. In other words, the situations in which the steam plough can be employed with success are exceptional, because a very considerable outlay is absolutely required to prepare most farms for its employment. An analysis of most of the reports published, will show that very large rectangular fields, and good roads traversing the farms, are the distinguishing features of those districts where steam has proved most successful as a cultivator. The horse can work anywhere with advantage; steam cannot; and without suitable preparation its employment must end in loss and disappointment. The Duke of Sutherland, in company with many others who have capital at command, have expressly prepared hundreds of acres for his majesty Steam. On these lands, the anchor—always troublesome and unwieldy—is no longer needed; stout posts, fixed 30 yards apart along the headlands, supplying the necessary support for a chain and snatch-block which take the place of the anchor. As a rule, however, our English farms are picturesquely broken up by intervening hedge-rows, into fields much too small to be economically tilled by the steam plough under its present form; and there is every reason to donbt that an early removal of these fences will leave a fair opening for the supersedal of horse labour by steam.

The English farmer usually spends his capital freely, once he is convinced that he spends it to advantage; and we do not conceive that the price of a 12-horse engine and set of tackle, say £850, retards the introduction of ploughing apparatus in any material degree. Machinery, if good, costs money, and a good article is always worthy of a fair price. But, unfortunately, the class of machinery which is employed to till our land, is exposed to such peculiar and unforeseen risks that "breakdowns" are of constant occurrence. The actual value of a share or skyfe may be very trifling; but the stoppage of the entire apparatus until it is replaced, is a very considerable item of expenditure; and when we reflect that in certain soils the delays from this cause alone, have been sufficient to reduce the average diurnal work to three acres, for weeks together, we can understand the objection which a farmer may have, to the introduction of steam as a substitute for the trusty horses, which accomplished their task with clockwork regularity. Things are better now perhaps than they were, in this respect; but we recollect an instance, not many years ago, when a cart left the foundry every morning with a load of shares, returning in the evening, with those broken during the day by a very good set of machinery, ploughing a common in Staffordshire. In very heavy soils, a competent authority tells us, that "a stone the size of a man's fist will break a share." We never yet have heard any valid objection urged against the use of wrought iron and steel shares in such cases: if one did not exist, we presume they would have superseded those of cast iron long since. Unfortunately, breakages are not confined to shares; ropes, anchors, windlasses, and engines being exposed to almost equal risks. No one who has not had actual experience in the construction and working of machinery of this kind, can form an idea of the trials to which it is put. Much depends on attention to little matters of constructive detail, on which the fate of a week's work may depend.

It is to be hoped that the experience of the next few years will so far advance the science of steam cultivation, that delays from the breakage of tackle, may be almost wholly obviated. We feel very confident that such will be the case. Breakages, however, bad as they are, are not the sole obstacle to the perfection of the steam plough. The weight and size of a 12-horse engine is frequently quite sufficient to exclude it from many farms which could be cultivated with advantage by lighter though not less powerful machinery. If fitted as a self-propeller, with wide wheels and an under drum, its total length cannot be much short of 20 ft., while its breadth will render the uprooting of gate-posts necessary before it can enter most fields. If not a self-propeller, our crooked farm lanes afford little scope for the exercise of the capabilities of a team sufficiently powerful to draw it to its destination through a foot or so of November mud. From many reasons we are disposed to look with favour on Mr. Collinson Hall's system of working two 6-horse engines in combination. The division of the weight effected by this means is a most important advantage; while the first cost of the apparatus as a whole, the anchor being suppressed, cannot be much greater than that of one on the single-engine system. The difficulty of starting and stopping both engines simultaneously, is a considerable, but not, we imagine, an insurmountable objection, which may be overcome possibly by very simple means. Certain it is that a single engine much under 12-horse power, is of little avail for cultivating land on any system; yet, such an engine is far too powerful for any of the other operations required on a farm, such as thrashing, root-cutting, &c. Not one in twenty of our farmers possess a thrashing-machine of their own, preferring to hire one when occasion requires. The farmer who possesses a set of double-engine ploughing tackle can easily find employment for both engines, during the thrashing season, by purchasing a second machine. The supply of horses to remove the engine from farm to farm, is generally limited; and the transportation of a 12-horse engine several miles, over bad roads most probably, is a serious consideration, from its great weight.

We have said that farms to be tilled must be adapted, by a considerable outlay possibly, to the requirements of the machinery which is to work over it. The interests involved will, in all probability, postpone for years the universality of such an adaptation. Those interested in the progress of the steam plough should, meanwhile, exert themselves, as far as possible, to meet the present demands of the farmer, by producing machinery as flexible—so to speak—in its application as possible. The engineer is too apt to suppose that the farmer does not really know what he wants; such a conclusion is absurd. Our agriculturists, as a body, know very well how they require their land tilled; and so long as that is done for them with ease, regularity, and economy, they will not criticize the means by which the desirable end is obtained. Nothing discourages so much as constant breakages, however trifling; and we do not hesitate to assert that, but for them, steam ploughing would now hold a very different position from that which it does. The farmer requires reliable machinery, as well as the manufacturer, the steamship proprietor, or the railway company. That, once supplied, fences will be levelled, money expended, horses sold, and the steam plough take its proper place, as a worker of the soil, far more reliable than animal power.

STEAM HAMMERS, AND THE BEST FOUNDATIONS FOR THEM.

Since the discovery and introduction of the arts of puddling and rolling wrought iron, by the talented, but very ill-used Henry Cort, no invention connected with the forge has been fraught with more importance than that of the steam hammer. Its employment has led to vast and startling improvements in forging, and in smith's work of all descriptions. The steam hammer may, with truth, be said to have knocked down, and annihilated practical difficulties which only a quarter of a century ago were considered unconquerable. It has enabled the smith, and the machinist to achieve triumphs which were once unhoped for and apparently unattainable, whilst by lessening the cost of both heavy and light forgings it has stimulated the iron trade to a very material extent.

The steam hammer is a docile and invaluable servant; but, like human servants, it demands proper treatment in order to develop its full efficiency and usefulness. It may be perverted to the worst purposes, and be made productive of the worst results, if entrusted to careless or "unknowing hands." For example, if the workman in charge of such an apparatus attempts to obtain from its action too much at a single heat of the forging in hand, he will probably damage the latter to a very considerable extent. The iron will inevitably in such case be crushed, mutilated, and probably crystallized to such a degree as to be deprived of its best elements, and thus rendered totally unfit for the purpose to which it is to be devoted. Great judgment, skill, and a well-practised eye on the part of the steam-hammer manipulator, are essential to the making it productive of sound work.

It was objected to the steam hammer on its first introduction, that it would lead the forgeman or smith into perilous temptation. By its aid, it was said, he could readily cover defects in forgings, whether arising from overheating

or other causes. Like other merely theoretical objections to new inventions, this notion has been swept away by the practical use of the instrument, and a return from it to the hand hammer would be deemed as unwise as would be a relapse from the planing machine to the cold chisel. It has become a necessary concomitant to the forge, and improvements in its details and mode of action are alone to be hoped for or sought after. Its *principle* is fully established.

We have said that care is required in dealing with the steam hammer, and one of the primary points to be looked to is unquestionably the obtaining of the proper degree of heat in the forging upon which it is to act. Overheating especially is the bane of forged work. Vain will be all attempts to remedy this vital evil. The best qualities of the material will be eliminated by it, and the finished forging will be but "a mockery, a delusion," and perhaps "a snare." It will never be sound or tough, although in appearance it may be both. Of course it is necessary that the quality of the iron in the first instance be good—that is to say, there should be present in it the minimum quantity of foreign matter, as sulphur, scoria, or oxides of any kind. This desideratum will be best effected by the most scrupulous attention to the fuel used for heating the forgings. It is a well understood fact, that if coals be used in the forge furnace which are impregnated with sulphurous or other foreign and deleterious matter, the forging will imbibe the poisonous particles and become vitiated accordingly. Perhaps the Belside Hartley and the Hastings Hartley coal are the best known kinds for forging purposes. They at least are freest from extraneous bodies. Having obtained the desiderata of good iron and good fuel for heating it, the next consideration should be to use both properly. The fire-box should never be *filled* with fuel, whatever the character of the material; for if it be so, the forging will occupy a long time in becoming properly heated, and a scale or crust will be generated on its surface. The homœopathic, rather than the allopathic, system of furnace treatment is undoubtedly the best. A lazy furnaceman may practise the latter, but a judicious one will certainly administer small quantities of fuel at frequent intervals, and thus add materially to the chances of obtaining a good forging.

If this and other minor conditions be attended to, the iron, when duly heated, will present a semi-fluid or pasty appearance. In this state it is fit for welding, and no time should be lost in effecting that operation. When exposed to the air, oxidation, or scaling as the common term is, rapidly commences, and no amount of sand, however carefully applied by the smith, will prevent the fatal contingency. A very small portion of the cleanest and purest sand obtainable may vitrify on the surface of the forging, and thus protect it to some slight extent from oxidation, but careful heating and a prompt application of the steam hammer are the best means of ensuring a sound weld.

It is not requisite to dwell upon the fact that the fewer times a piece of smith's work is submitted to the fire the better, because few smiths are ignorant of it. It is a *sine-quâ-non* indeed to do as much at each heat as possible, and hence again the advantages of a quick eye and ready hand. It would be impossible to enumerate here the varieties of forgings, large and small, which may be and are economically and effectively produced by aid of the steam hammer. The interminable demands made upon the appliance in the establishment of an ordinary engineer, and the ready way in which they are responded to, prove it to be a veritable servant of all work, and literally a "true friend at a pinch." The class of smith-work in which the steam hammer is used to great advantage may be specified. It is that in which the welding on of swells or collars is the distinguishing feature. By hand labour this important branch of the smith's duty is always unsatisfactorily done. No dependence can be placed upon the work, however "cunning" the hand of the manipulator. The steam hammer, on the contrary, with the assistance of proper tools, properly handled, never fails to make "a good job" of such matters. The extensive use of blocks or dies in the shaping of small pieces of smiths'-work, and which tends to ensure sound and clean forgings, is due, almost entirely, to the steam hammer. It would be possible to add very lengthily to this list of valuable qualifications of the steam hammer, as an adjunct to both the peaceful, and the warlike sections of engineering—to do so, however, is superfluous. They are known and recognized by almost all practical men.

Let us turn our attention, rather, to the best means of fixing or seating the apparatus so as to ensure its stability and permanent usefulness. We have no hesitation in saying that, whatever the character of the soil may be, in the locality in which it is determined to place a steam hammer, the foundations for it should be composed of timber, the balks used ought not to be less than 10 in. or 15 in. square, and they should be from 20 ft. to 35 ft. long, according to the magnitude of the hammer. Framed together at right angles and bolted by rough spikes of iron, they should lie in at least six courses. The distance between the timbers must be left to the judgment of those to whom is confided the erection of the hammer, and depends somewhat on the nature of the sublying soil. The main object is to secure as large an area of surface foundation as circumstances will admit of. If this rule be attended to, there will be not only no subsidence after long working of the apparatus, but no tendency to that evil. The elastic nature of the timber courses will assuredly keep the bed of the hammer up to its original level, besides obviating the destructive jarring of the piston, &c., which sometimes manifests itself most disagreeably.

It may be said that timber so employed cannot last very long; but many instances might be adduced of its having remained sound for over twenty years; and we have little doubt that carefully-selected pine, in a dry soil, would not deteriorate very much in half a century. It must be admitted that the foundation of a steam hammer has a great and important task to perform. Besides sustaining the weight of the apparatus when in a state of rest, it may have to sustain six times that weight if the hammer be in operation—to say nothing of the alternating shocks resulting from each impact upon the forging. Concrete may be used if the bottom upon which the timbers rest be soft, but if it be so introduced, care must be taken to put in a stratum of sufficient thickness, or it will crack, and fail to perform its mission.

In some cases, it might not be improper to diminish the size of the timbers towards the surface of the ground. This would have the effect of concentrating, so to speak, the effect of the blows, and thus prevent an undue elasticity. The introduction of piles as foundations for steam hammers cannot, except in rare instances, be attended with practical good. Horizontal timbers, laid in courses, and covering a wide area, form, as we think, the best possible foundations for them. Thus provided, steam hammers will give out their powers most efficiently, their durability will be enhanced, and the cost of reparation will be minimized.

THE MONT CENIS TUNNEL.

The greatest obstacle which the civil engineer can by possibility encounter in the formation of a line of railway, is a great mountain-chain. Rivers, however wide, can be spanned in detail by a series of bridges springing from pier to pier; valleys, if too deep and wide to render the construction of an embankment desirable, can be traversed by viaducts on the same principles; mountains, however, permit the passage of a railway only under the conditions of a succession of steep inclines, or by the tedious and expensive process of tunnelling. Both means have been resorted to; and the elevated chains of both hemispheres afford us examples of the most magnificent engineering works which have ever been proposed or accomplished. In a recent number, we discussed at some length the means adopted for carrying the Great Indian Peninsular Railway across the Syahadree Hills, up the Bhore Ghaut. There we have an example of the incline system carried almost to its greatest limit. In the Mont Cenis Tunnel, we find nearly similar difficulties overcome on a totally different principle; while the magnitude of the works involved, and the means adopted for conducting them to a successful conclusion, render the undertaking one of the most remarkable in the history of engineering.

The Mont Cenis Tunnel is intended to connect Savoy with Piedmont; and in the district chosen for the future railway, the chain of the Alps extends about due east and west between two nearly parallel valleys. According to the plan which has been adopted, the northern entrance will be below Modane, about 18 miles west of Mont Cenis. On the south side the railway will emerge near the Alpine village of Bardonnèche, at a level considerably higher than the Modane entrance. Beyond the preliminary surveys required to lay out the line, nothing has yet been done towards the construction of the 25 miles of railway over an extremely difficult line of country, required to connect Bardonnèche with Susa; and we cannot consider the decision of deferring for the present the commencement of this portion of the line, as other than prudent, as it permits the concentration of the energies of all connected with the undertaking, on the vastly more important work of the tunnel. The greatest recommendation to the line from Bardonnèche to Modane, lies in the fact that it is much shorter than any other suggested for traversing the Alps between Savoy and Piedmon

The lowest pass of this chain on the Italian side is about 2,100 metres (a metre is 39.37 in., or a little over 3¼ feet) above the sea level; and the tunnel will enable the railway trains to cross the mountain at a height of about 1,333·8—*i.e.*, 766·2 metres below the present pass. Its southern opening at Bardonnèche, in the valley of Susa, is 1,335·38 metres above the sea level; from this point it rises 0.5 per 1,000 metres up to a distance of 6,100 metres—that is, to about the middle of the gallery, when it again slopes down at a declivity of 22.2 per 1,000 to its northern opening near Modane in Maurienne, which lies at a height of 1,202.82 metres above the sea: so that the actual difference of level between the two extremities is about 320 ft.; the Italian end being so much the highest. The steepest gradient within the tunnel equals about 1 in 45, rising to the middle from the French side, descending then towards the Italian extremity, at the rate of 1 in 2,000. One-half the tunnel thus having a stiff gradient, while the remainder is, practically speaking, a level.

When we consider that the total distance to be excavated through hard rock is about

miles, at such a depth that the iking of shafts is impossible, the mag-.ude of the difficulties to be surmounted iy be realized. Under the first idea, that inual labour alone, employed at each d was available; the termination of the ork could not be calculated on under twenty-e years; hence its promoters, reflecting on e vast annual outlay, necessarily extending er that period, so brought their influence to ar on the French Government, that they cceeded in procuring a convention—not, owever, until last year—with France, by the rtue of which the latter State undertook to iy the sum necessary for the construction of 110 metres of the tunnel—half its length— the rate of 3,000f. per metre, or 3,000,000f. r kilometre, on condition that this compen-ation should not, taken altogether, exceed ,000,000f., reckoning the work upon the nderstanding that it should be executed by rdinary means, and allowing a period of venty-five years as necessary for its comple-on; but they stipulated that, in the event of ie tunnel being accomplished in less than venty-five years, beginning with the 1st of anuary, 1862, the capital of 19,000,000f. vould be increased at the rate of 500,000f. for very entire year that might be deducted from he maximum of twenty-five years. If the vorks were to last less than fifteen years, the remium would be raised to 600,000f. for every ntire year's reduction; so that, if the work vere actually achieved in twelve and a-half vears, the Italians would gain a premium of nore than 16,000,000f. Moreover, as the French Government does not reimburse the Italians immediately, but pays the interest of the sums due, and these interests may be reckoned at 6,500,000f., France will, at the end of the work, be indebted to Italy to the amount of about 31,700,000f.

The tunnel was begun in 1857, with ordinary means. But that year and the two following were spent chiefly in preliminary operations, such as the construction of houses, workshops, &c., and up to the end of the year 1860 not much over 800 yards had been executed. The extremely slow progress of the works, by mere manual labour, stimulated the ingenuity of the engineers employed in their execution, MM. Grandis, Grattoni, and Sommeillier, who had already tried a boring machine designed by an English engineer, Mr. Bartlett, without success. Mr. Bartlett's contrivance was wrought by steam, and could not be applied to a tunnel where air could not be had for combustion. The Italian engineers proposed to substitute compressed air instead of steam; and, notwithstanding long opposition on the part of foreign scientific men, their method is now in full operation, and their success exceeds the most sanguine expectations. At the Bardonnèche end of the tunnel these gentlemen have availed themselves of a fall of water about 86 ft. high to force air to a pressure of about 90 lbs. on the square inch, within wrought-iron cylindrical egg-ended receivers.

The machinery employed for this purpose is extremely simple, the principle involved being very similar to that of the hydraulic ram. The compressed air, is conveyed from the receivers by a cast-iron main, about a foot in diameter, to the face of the working, where it puts the boring apparatus in action. This machine, nearly 8 ft. high and 10 ft. wide, occupies the drift-way, or heading, which precedes the finished tunnel, enlarged from the heading by manual labour. Eight or ten jumpers are put in motion by suitable pistons, reciprocating within cylinders, which admit of such a motion from time to time as will expose every portion of the rock face to the action of the jumpers. Varying with the hardness of the rock, the average time required by the machine for boring a hole 32 in. deep is rather less than an hour. As soon as about 80 holes have been bored into the rock the machine is disconnected from the main tube conveying the compressed air, and is then withdrawn on rails to a distance of 80 or 100 yards, behind massive wooden folding doors, designed to protect the machine and the workmen from the effects of the explosion. Miners then enter the gallery and charge the holes with powder, light the fuses, and then retire behind the doors, which are closed. After the explosion, another gang of workmen enter the gallery, and set to work to remove the rubbish in waggons running upon narrow rails laid beside the main track, and in about six hours the way is clear for the return of the machine with a fresh gang of workmen, when the same series of operations is commenced, the work being continued day and night with but rare and short intervals of repose. The rock is a metamorphic schist of variable composition, but apparently all belonging to the carboniferous series, for the most part extremely hard, and especially difficult to work in parts where it is traversed by veins of quartz, that very quickly destroy the steel points of the jumpers. Fortunately, the rock is so close that it effectually prevents the entrance of water in excess; no more having been hitherto encountered, than just suffices to keep the jumpers properly wet; the water being introduced into the holes in extremely fine jets under the action of the compressed air. The machine at the Modane face of the working is supplied with air by a regular pumping apparatus put in motion by a large wheel driven by the waters of the Arc, the torrent which was at first employed to drive a machine similar to that at the Bardonnèche end, frequently failing in its supply. The air, after putting the pistons in motion, by escaping within the tunnel serves to ventilate it in the most perfect manner. Gas is introduced at the sides of the working; good light and ample ventilation securing the comfort of the labourers, and consequently the rapid advance of the works. The total estimated quantity of rock to be excavated is 600,000 cubic metres, or about 784,666 cubic yards. As the tunnel is 13,354 yards long, this will give for the lineal yard forward, and for the whole face of the tunnel to be removed, nearly 58 cubic yards. At the average advance of 1·17 metre per day, which the engineers calculate on from the progress already made, this will give a daily removal of 73½ yards cube; and if both faces are worked at the same progressive rate, it will yield 147 cubic yards of daily excavation for the joint work of all the boring machines in operation, and at this rate of working it will require about 14¾ years to complete the excavation. Many particulars respecting the tunnel have been laid before the Italian Parliament by General Menabrea, Minister of Public Works, from which we select the following, which will give at least a good idea of the importance of the undertaking and the progress already made :—" In 1862, in order to pierce 380 metres of the side of Bardonnèche, the men were employed 582 times, each time 7 hrs. 39 min., for boring, and 6 hrs. 2 min. for loading and exploding the mines and clearing away the rubbish. In these 582 operations, 45,751 holes were bored, from 75 to 80 centimetres in depth; 72,538 chisels were set to work; there were 54,785 blasts, 18,622 kilogrammes of gunpowder were fired, 76,000 metres of match line were burnt, and 1,334,000 cubic metres of compressed air were consumed, equal to 8,004,000 cubic metres of atmospheric air. The workmen, on the 1st of January, 1863, were 720 at Modane, and 900 at Bardonnèche—altogether, 1,620. The grants for the work were as follows: For 1857, 1,000,000f.; for 1858, 3,500,000f.; for 1859, 500,000f.; for 1860, 2,500,000f.; for 1861, 3,000,000f.; for 1862, 2,000,000f; for 1863, 2,000,000f.; altogether, up to this day, 14,500,000f. The expense, up to the end of February, has risen to 13,182,603f. 18c., and the Minister has in hand 1,317,396f. 82c. He, therefore, thought that it would be necessary to apply to the Chamber for an additional grant of 500,000f., to enable him to finish 600 to 700 metres of tunnel, which were to be completed before the end of the present year."

THE WRECK REGISTER AND CHART FOR 1862.

This synopsis of the returns made by the Board of Trade to Parliament, of the wrecks and casualties which have taken place on the coasts, and in the seas, of the British Isles during the past year, is now before us.

Compared with previous years the register informs us that the wreck experience of the past year is very unfavourable. But the number of lives lost is fortunately considerably under the average, owing chiefly to the valuable and prompt services of life-boats and other means employed on occasions of wrecks on our coast. The wrecks and casualties in the year show a large increase on the average of those during the preceding eleven years. The number of wrecks in the last eleven years was 13,657, while the total voyages made to and from British ports in that period were 2,745,910—so that 1 ship was wrecked out of every 201. During the past year, as previously stated, the number of voyages of vessels to and from ports in the United Kingdom was 268,462, and out of this large number 1,827 casualties occurred—or 1 in every 147.

In the past eleven years, from the above wrecks 1,775 persons were lost, or nearly 800 each year. Last year, it appears from the returns that the lives of 4,729 persons were imperilled on the coasts of the British Isles, of which number 690, or 14·59 per cent. were lost. The wrecks and disasters for the year 1862 may be thus classed :—

	Vessels.
Totally wrecked	455
Seriously damaged	695
Totally lost in collision	66
Damaged seriously by collision.........	272
Injured by collision.........................	339
Total	1827

This number of disasters for last year is at the rate of five per day; the months of January, February, March, October, November, and December being the most destructive to ships.

Amidst the desolating scenes which the Wreck Register and Chart reveal, it is consolatory to know that by means of life-boats, the life-preserving apparatus, ships' own boats, and other means, 20,150 lives have been saved from a watery grave during the past seven years, of which 4,039 were rescued last year.

The following is a summary of the means used in saving the 4,039 lives from wrecks on the coasts of the United Kingdom during the past year :—

By life-boats and rocket and mortar apparatus	637
By ships, ships' own boats, shore boats, steamers, &c......................	3389
By individual exertion....................	13
Total	4039

Schooners and brigs were, as usual, the most numerous description of vessels that were lost during the past year on our shores. These are usually employed in our coasting and coal trade, and the destruction of hundreds of them even in moderate gales, is now reduced to a matter of certainty.

In December last seven vessels foundered off the east coast of England—with the loss of all hands —while engaged in coasting voyages. One of them was a collier sloop 71 years of age! Another collier brig also foundered in October last, and 7 out of 9 of her crew were drowned. She was 99 years old!

It also remarked that in perfectly calm weather, **23 vessels were wrecked**; in light airs, 28; in light **breezes**, 56; in gentle breezes, 43; in moderate breezes, 110; in fresh breezes, 187; in strong breezes, 195; in moderate gales, 75; in fresh gales, 170; in strong gales, 199; in whole gales, 218; in storms, 63; in hurricanes, 69; and in unknown and variable weather, 52.

It is a lamentable fact, in regard to collisions, that 141 took place in fine and clear weather; the whole number of collisions during the year being 338—102 in the day-time and 236 in the night. Last year 11 collisions occurred between steamers, and 190 between sailing-vessels, while both were under way. 32 collisions also took place between sailing-vessels, one being at anchor and another under way at the time; but no collisions occurred between steamers under these circumstances. 46 collisions likewise took place between steamers and sailing-vessels, both being under way; and 6 only when sailing-vessels at anchor were run into by steamers. 53 collisions also occurred by vessels breaking from their anchors or moorings. We earnestly trust that the admirable regulations which the Board of Trade have just published to prevent collisions at sea will materially tend to lessen the number of these fearful disasters.

The most disastrous wrecks, with the greatest loss of life, occur between that part of the coast extending from Skerries and Lambay to Fair Head and Mull of Kantyre. During the past thirteen years 1,641 lives were lost in that district. The next is from the North Foreland to St. Katherine's Point, which during the same period claims 1,136 lives.

The estimated loss of property involved in the destruction of a portion only of the vessels wrecked in the last six years amounted to four-and-a-half millions of pounds sterling, although the total amount, being unreported, cannot be ascertained; but who can appreciate the value of the precious lives lost in those terrible disasters, except those at our seaports and fishing villages who are now widows and orphans or friendless who have bewailed with unutterable anguish the loss of a husband, father, or near relation?

On the other hand, it is most gratifying to find that in these six years 4,169 lives were rescued from the jaws of death by life-boats and the life-saving apparatus *alone*. It may be proper to observe that these means of saving life are rarely used except under the most perilous of circumstances.

It may be interesting here to recapitulate briefly the operations of the National Life-boat Institution, which has now 125 life-boats under its management. During the past year, in addition to saving twenty-one vessels from destruction, 358 lives were rescued by the life-boats of the society. For these services rewards amounting to £915 18s. 1d. were voted. The number of lives saved by the life-boats of the society, or by special exertions, for which it has granted rewards since its formation, is 13,220. For these services 82 gold medals, 733 silver medals, and £17,200 in cash have been granted as rewards. The institution has also expended £75,380 on life-boats, life-boat transporting carriages, and boat-houses. Surely a society which has thus been productive of the greatest services in the cause of humanity, will not have to appeal in vain to the public for help to enable it to continue its merciful work on our dangerous sea-board! We may add that contributions in aid of the great and important work of the National Life-boat Institution are received by all the bankers throughout the United Kingdom, and by the Secretary, at the Institution, 14, John-street, Adelphi, London.

THE APPLICATION OF PHOTOGRAPHY TO MINING.

WHEN St. Victor first made his experiments in the application of light to senitized surfaces, and, aided by Daguerre, worked out the great problem which they were both endeavouring to solve, he little thought what an immense advantage would arise to the world at large from his making a practical thing of the action of light upon metallic oxides.

The casual observer, as he passes the numerous groups of photographic pictures which meet his gaze in almost every street, looks upon the art as something that panders to the vanity of the multitude, or tends to keep alive the bonds of memory. Even the most practical men, those who are engaged in the development of the resources of the country, in their hasty conclusions, deem the work of the photographer, is but an idle occupation, and of no actual benefit save to the operator himself.

But while the astronomer takes pictures of the sun, moon, and stars; while the mechanic obtains views of his machinery, so perfect in perspective, so accurate in proportion and detail, that thay may serve as working plans; and while the architect produces admirable representations of the buildings he constructs, all, with the camera, the mining engineer also does in many instances avail himself of the same method to illustrate the advances he has made in his labours, and to show the grounds upon which he is working.

It is seldom that the Board of Directors ever visit the mine; the stockholders themselves rarely travel thitherward; and all the information which they gain of the progress of the work, or the character the country at the mine, is derived from the terse and sententious reports of the manager. Did the manager understand the use of the camera, a knowledge which is very easily acquired, he could show from actual views, the progress made in his work, weekly or monthly, as might be desired. He could present pictures of the mine and its surroundings, show the bearings of the outcrop, the trend of the vein, the features of the adjoining country, and, in fact, each and every minutia that would aid greatly in satisfying the Board of the correctness of his system, and in familiarizing them with the property whose interests are entrusted to his guidance. When the construction of the buildings or the erection of machinery is progressing, a few minutes' work with the camera, at the close of each week, will show the exact stage of the advance made since the last view was taken. So much wall has been built, so much machinery has been put into position, so much excavation has been made, and the quick action of the camera has told the story more plainly, more truthfully, than a volume of words could do.

Much of the value of the vein can be forshadowed by the physical features of the country in which it is situated. If easily accessible, even a low grade of ores could be worked profitably, while those which might be very rich would, from the expenditure necessarily entailed upon them, by the difficulties of their position, never be remunerative. Here the camera becomes useful in its correct delineations of the surface, showing to those who reside at a distance from the mine the actual position of the vien and the facilities of approaching it. It is true that an absolute necessity does not exist for these features of the mine to be presented to the notice of the Board; but it cannot be doubted that the more fully they understand their property, the better they will be able to manage it. It is not possible for all to visit the mine, and by actual inspection, and examination, make themselves conversant with all the local details of it; but they can avail themselves of the aid of this branch of science, and bring as it were, the mine to their own offices or firesides and inspect it at their leisure. Those who have seen the views which have been taken, from time to time, by the different artists of this State of various mining localities, can readily understand how greatly such delineations must aid in a correct estimate of the value of such properties by those who cannot visit them in person. Nor is it necessary to be encumbered with costly or heavy and clumsy apparatus; a light and portable camera, with the stand upon which to place it—so light, that both can be carried with ease by sustaining their weight upon two fingers of the hand—with lenses that can be readily carried in the ve pocket, can readily be obtained at any of the photographic ware-rooms. The writer of this article has a complete apparatus, which is packed in a box about one foot square, containing the camera, glasses for pictures, lenses, and the requsite chemicals; the whole of which does not weigh over a dozen pounds. And often in journeying through mining districts he has stopped his mule, taken a view, and in eight minutes been again upon his journey.

Such is the progress made in the art, that plates are now prepared which may be kept for years, if not exposed to the light, and then placed in the camera and a view taken upon them. This advancement in the art precludes the necessity of carrying bulky packages of bottles and chemicals, while travelling, to obtain good views, and thus places it in the power of any who are so disposed, to bring back with them picturesque delinations of the scenes through they have passed. It can be rendered practically useful by illustrating the progress of work upon the mines.—*San Francisco Mining and Scientific Press.*

STEAM PLOUGHS AT WORCESTER.

WE extract the following interesting Paper from the "Journal of the Royal Agricultural Society of England." It forms a portion of an essay entitled "Five Years' Progress of Steam Cultivation," by Mr. J. A. Clarke. Mr. Clarke writes as follows:—

In selecting proofs from the great mass of evidence which is cumulating every day, I may, first of all, take steam culture as represented in the trial fields at Worcester.

Some systems familiar to visitors of our "country meetings" have been abandoned. No such thing as a locomotive engine travelling over the land, yoked to one or more traction-implements, appeared at Worcester. And though a locomotive-engine, delving the soil by rotary spades, has been exhibited at the agricultural exposition of Lille, our English inventors have at present no real embodiment of wood and metal of the mechanical idea so philosophically and pictorially placed before us in the "Chronicles of a Clay Farm." Steam-tillage in 1868 consists in dragging a traction-implement with a wire rope (or a substitute for it), hauled either by a stationary motive-power, or a motive-power moveable along the headland.

Leaving out of view the so-called "traction" engines, or highway and farm-road locomotives, we find "entered" in the Worcester Catalogue the steam-culture machinery of thirteen different exhibitors.

Mr. Thomas Beards, of Stow, near Buckingham, showed a plough adapted for any system of haulage. A rectangular iron frame upon two furrow-wheels and two land wheels, carries at each end a lever-frame with two plough-bodies, for turning over two furrows at once; and the implement traverses backward and forward, without turning round at the ends of the field, the two sets of ploughs being alternately dropped into the ground or held aloft in the air by chains and a barrel upon the top of the frame. This is a modification of the "balance" or "equipoise" principle exhibited by Messrs. Fisken, at Carlisle, in 1855.

The implement of Mr. William Steevens, of Hammersmith, is also designed for any system of rope-traction. Two sets of ploughs pointing towards each other, are so hung within a main carriage-frame (with steerage-wheels) as to rise or fall with a parallel motion—the share-points and mould-board heels together; the bell-cranks and rods which effect this also balancing the two sets, in order that they may be easily lifted or lowered. A scale of inches upon the main frame marks the depth to which the ploughs are set, and the depth of the furrows can be instantaneously altered without stopping the implement. The plough-bodies can be removed from their respective frames and replaced by cultivating-tines; and, again, instead of these, a harrow, taking 10 to 15 ft. breadth at once, may be affixed below each of the rising and falling frames. There seems to be no reason why double-breasted or ridge-ploughs, or, indeed, almost any form of tillage tool, should not be added at will to the fundamental framing. Mr. Steevens has also produced an improved rope-porter, enabling the rope to be readily lifted off the roller while the plough is passing. The work accomplished by the implement (worked by Messrs. Howard's form of tackle manufactured by Messrs. Garrett) was certainly of good quality, though a breakage occurred from lack of strength for excessively hard operations.

Mr. J. A. Williams, of Baydon, Wilts, has directed much attention to combinations of implements for steam-power. One of his arrangements consists of a large field-roller, with one heavy drag-harrow before and another behind it, set in a rectangular frame, which is pulled backwards and forwards without turning. Two lighter harrows, hung, one at each end of the frame, are raised when preceding, but lowered into work when following, the heavy drags and roller. Another set of light harrows, or a chain-harrow, is attached at the side; the whole covering a breadth of 13 ft., but adapting the position of the several implements to all inequalities of surface. The steerage is effected by simply diverting the rope to one side or the other, more or less out of the line of draught. For reducing a roughly broken surface, at a large acreage per day, this is a [illegible] efficient and economical machine. Mr. Will[illegible] cultivator carries its tines in lever-bars, whic[illegible] and fall of their own accord, like the coulter[illegible] drill, taking 6 ft. width at once. For these [illegible] may be substituted three "double-tom" [illegible] ploughs, by which land is ridged for [illegible] laid up for winter exposure at a wonderf[illegible] rate. This implement is turned at the [illegible]

by the action of the ropes, passed round the fore part in bows, which also hold off the tail-rope in its proper place. The same practical exhibitor has also a land-presser for steam-power, so constructed that six wheels press as many furrows at once, each wheel riding independently of the rest.

Mr. C. Clay, of Wakefield, has a cultivator of peculiar action. The tines are fixed to cross-bars, which are at liberty to rotate part of a revolution; so that when the implement begins its journey, one-half the tines enter of their own accord into the ground, while the other half (pointing in an opposite direction) simultaneously rise out of work. Hence the workman has only the steering to manage. The implement runs upon a single pair of wheels.

The rotary rolling forker, which was a familiar object at the Society's meetings a few years ago, has reappeared in the modified form of a digging-machine, invented by Dr. G. Ager, of Aylsham, and exhibited by the manufacturers, Messrs. E. R. and F. Turner, of Ipswich. A set of rowels of large diameter, with curved tines or teeth, being set in motion by the onward progress of the implement, penetrate and lift up the soil; while a second and smaller set of rowels, driven by toothed wheels and pitch-chains from the former set, clears the teeth of earth, much as the revolving spurs of a Norwegian harrow clear each other. The machine is very similar to one which the Rev. S. Smith, of Lois Weedon, invented and worked with admirable effect a few years ago. The work produced by the present digger is reported by employers to be very effective and valuable, and to be performed with a comparatively small expenditure of motive power. The forked tilling part of the machine is placed in a circular frame, to which the hauling-ropes are attached, and is turned half-round upon friction rollers in this frame, for working in the opposite direction.

Among the articles designed to aid steam tillage, I must not omit a clever little contrivance of Mr. W. S. Underhill, of Newport, Salop. To prevent that serious delay—the breaking of a rope—and to preclude the risk of great damage from sudden obstructions, inattention to signals, &c., the rope is attached to the implement by a spring-hook—that is, a hook so made as to release itself from its hold when a spiral spring upon its shank becomes compressed beyond a certain point; and this yielding strain may be set to any number of cwts. at pleasure. The device is good, and the cost low; and the hook is adapted to any apparatus not fitted with "taking-up gear" upon the implement.

Coming now to distinct systems of haulage, I find entered in the Catalogue, but not present in the Show-yard, the apparatus of Mr. W. Fisken, of Stamfordham, Northumberland. The peculiarity in the invention (which has undergone great modifications since its early appearance in Scotland, in 1852, and its exhibition at Carlisle, in 1855), consists in conveying the power from a stationary engine by means of hemp-rope running at a high velocity. At first the windlass, with ploughs attached, worked its way to and fro by coiling or by gripping a fixed and immoveable wire-rope; then the implement was made to travel by means of a drum armed with cutting-blades that laid hold of the ground; and, lastly, this has been abandoned for the present plan of two self-moving anchor windlasses, one on each headland, alternately coiling a single wire-rope which pulls the plough,—the endless hemp cord mounted upon porters, along one headland and across the field alongside the furrow, transmitting power and motion to the two windlasses. The price of the apparatus is marked excessively low; but now that we have learned to carry wire-rope clear off the land, and thus to take power to almost unlimited distances with very little waste in friction, I do not perceive what special advantages could be gained by the present form of this invention.

The apparatus of Mr. W. Smith, of Woolston, Bletchley, Bucks, is so well known that a description would be superfluous; and only a few minor alterations appeared in the tackle at Worcester. The double cylinder 10-horse ordinary portable engine had an additional band-wheel, formed in one piece with the fly-wheel, giving a choice of two speeds for lighter or harder work. The stationary four-wheeled windlass, with a couple of coiling-drums; the claw anchors let into the ground by digging holes; and the simple, strong, light, three-tined and five-tined cultivators, turned round at the ends of the work by the action of the ropes, present no apparent novelty in construction. The pulleys or snatch-blocks, however (four, five, or even six in number, according to the shape of the field), have been made with a deeper and more durable centre-boss rotating upon a longer pin; and the rope-porters standing upon curved wood rockers cannot tumble over, and are easily moved. In addition to the two grubbers of different sizes, Mr. Smith showed his combined cultivator and corn-drill (with grubbing tines and seed-coulters on one lever frame), which has been much lightened, improved, and cheapened in price since last year. This machine, thoroughly tested in extensive practice, enables the farmer to make a seed-bed out of whole ground, and sow it at one operation; with an admirable tilth, perfectly straight rows completely finished up on the headlands as elsewhere, the seed planted at regular depth, and all without the trampling of a single hoof. It is also adapted for haulage by other systems of rope traction.

Mr. E. Hayes, of Stony Stratford, Bucks, has introduced various modifications into this system of a stationary engine and windlass, and rope laid out round the field. Between the two winding-drums upon the same axis are hung three riggers or band-wheels, any one of which may be driven at pleasure by a belt from a broad rigger or sheave on the engine fly-wheel. The middle rigger on the windlass is simply a "dead rigger;" each of the others actuates at a slower speed one of the drums, by means of spur-wheels inside. To reverse the action of the drums, then, it is only necessary to slip the belt from one outside rigger to the other, without taking any toothed wheel out of gear, and without stopping the engine—which is a source of trouble and delay when the engine has but a single cylinder. The revolution of the slack or paying-out drum is arrested, ready for the reverse motion, by the momentary pressure of a steam-piston brake. But no attendant is needed at this windlass; for Mr. Hayes leads out cords from the windlass around the field, by which either of the anchor-men instantaneously shifts the reversing bar, when the implement arrives at the end of its furrow. So that no signalling is required, except in case of obstruction to the plough while on its journey; and this enables the farmer to work in the thickest fog, or by moonlight in a pressing season, with perfect safety to the machinery.

The improvements of Messrs. J. and F. Howard, of Bedford, embrace all parts of the so-called "round-about" system. Their 10-horse double-cylinder ordinary portable engine, actuated the stationary windlass by means of a spindle with universal joints, in place of a driving-strap, which is liable to slip in wet weather. The two coiling-drums are hung upon eccentric bosses, or hollow axles, both upon one carriage axletree; and by altering the position of these eccentrics either drum is raised or lowered at pleasure, in order to place its toothed flange in or out of gear with one of the pinions on the first-motion shaft above. Thus a very light, though powerful, two-wheeled windlass is secured; the stopping and reversing are easy; the motion of the drums can be stopped without shutting off steam; the slack or loose drum, dropping upon a fixed block, becomes its own brake; and the amount of frictional pressure in this braking action can be regulated at will. The next point that meets our attention is the provision made for holding up the rope off the ground; not only to save wear, but to economize motive-power. A tight or pulling rope will always hold itself clear above the land, even upon low rope-porters; but a slack or outgoing rope, even if passed over porters 3 or 3½ ft. high, commonly trails by far the major part of its length along the ground. Now, it appears from the dynamometer experiments of Mr. J. F. Harrison, C.E., and Mr. J. C. Morton, in May and June last, that a very considerable proportion of motive-power may be sacrificed by imperfectly carrying the rope. The draught of 440 yds. of Mr. Smith's rope, wholly dragging upon the ground, and passing round three pulleys, was 3 cwts.—equal to about half the weight of the rope; and the draught of 700 yds. of Mr. Fowler's rope, wholly dragging on the ground, and passed round the clip-drum and one pulley, was 4½ cwts.—equal to more than one-third the weight of the rope. When imperfectly carried upon rope-porters, the draught was diminished nearly one-half; and when the rope was held clear from contact with the ground, the draught was only ¾ of a cwt.—only a sixth of the draught when trailing its full length. Hence we learn that, in dealing with fields of tolerable size, 3 or 4 cwts. of draught (representing, at a pace of 3½ miles per hour, 3 or 4 mechanical horse-power) may be wasted from not carrying the rope at all; while there may be a difference of 2 or more horse-power between partially and perfectly supporting the rope above the land. The necessary tightening of the slack rope might be effected by applying a brake to the paying-out drum, but it would be very undesirable to do this. It was found in the aforesaid experiments that, while the draught of a certain length of the Woolston rope (running over porters at intervals of 20 to 40 yards) was 2¼ cwts. when the slack drum ran loose, it was only 2 cwts. with the brake applied as usual; so that partial braking is an advantage. When the brake, however, was pressed so hard as to keep the slack rope entirely off the ground, the draught rose to 4 cwts. A simple brake, then, while saving a slight amount of power, as commonly used, would involve a great loss by friction, if employed to hold up the rope completely. Accordingly Messrs Howard adopt a method of returning to the pulling rope a portion of the strain which retards the slack or outgoing rope. At a few yards' distance from the windlass a compensating pulley, loosely hung between two fixed pulleys, pinches the hauling rope into the groove of one pulley, while at the same time pinching the slack rope into the groove of the other pulley—so that the outgoing slack rope helps to haul the pulling rope; and while the pressure in this self-acting apparatus is proportioned to the strain exerted by the windlass upon the hauling rope, there is no pressure at all when the rope is doing no work—thus enabling the portion of spare rope to pass freely to the windlass as the implement commences its journey. The rope is more effectually carried, owing to this contrivance, than it is by the brake alone; but what proportion of power is thus economized has not been well ascertained. The back and forward bending of the ropes between these additional pulleys must prove a source of considerable wear; and hence it is very desirable that whatever compensating movement is devised should be applied to the windlass drums, rather than to the ropes. Mr. Fowler has such a windlass with compensating brake; but, owing to the varying speeds of the drums (according as more or fewer layers of coils are wound upon them at different parts of the journey of the implement), only a portion of the retarding strain is returned to the hauling drum. Probably a simpler plan will be introduced, in which only a single layer of coils will be wrapped either drum.

Messrs. Howard's rope is laid out round five or six pulleys (according to the figure of the field and the position of the windlass), and these are of larger dimensions than the Woolston pulleys—which Mr. Smith considers large enough to be still portable (though the rope in passing them is bent round a curve of but 13 in. radius). With improvements in carrying the rope (without an excessive number or rope-porters), some change will probably be required in the present system of claw-anchors, which are already troublesome enough in some situations; permanent posts, or temporary posts and chains, being available in the absence of self-travelling anchorages. The Bedford rope-porters are remarkably handy for moving from and replacing under the rope; and those porters which are out of the track of the implement are admirable for catching a rope that rides or rebounds—as when crossing over a hollow. I need not describe the cultivator with tines that point both ways (for travelling to and fro without turning), and rock of their own accord,—so that when the fore point is depressed, the hinder one is slightly raised. It is remarkably light, and strong too, and shares of various widths—from 2 in. to 13 in.—enable it either to cleanly cut all the bottom, or break up without cutting when the ground is suitable. Two sizes of this implement are made, with three and five tines respectively. For reducing the broken soil a set of double-action harrows is employed, in a peculiarly light framing, steered in a similar manner to the cultivator by a lever-movement altering the lock or set of the forward wheels. Messrs. Howard's new plough consists of two sets of plough-bodies pointing towards each other, upon two lever frames, which cross at their inner ends within a short main-frame having one large furrow-wheel and a couple of land-steerage wheels; all three wheels standing very near together midway of the length of the implement. But the two sets of ploughs are raised or lowered into work independently of each other; the weight of each set being counteracted by separate spiral springs coiled in boxes, instead of either wholly or partially counterpoised by the weight of the other. And to netralize the tendency of the ploughs to rise out of very difficult work (particularly on hilly land), the action of the springs is so adjusted as to only lift a portion of the weight when the ploughs are in position for work, but sustain the entire weight when the set is raised into the air.

(To be continued in our next.)

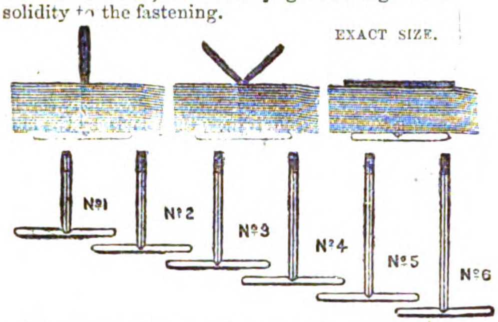
HART'S METALLIC CLIPS.

The following improvements in metallic clips for securing documents have been provisionally protected by Mr. H. W. Hart, engineer, of Fleet-street, London.

This invention refers to those T fastenings in which the leg or shank is composed of two separate pieces, which, after being inserted through the article to which the fastening is to be applied, are turned down, and embrace the article between the head of the T and the turned-down shank. Such fastenings, as hitherto made, are found to be weak, and readily open their whole length and break, or assume the form of a single strip of metal.

The present invention consists in stamping or otherwise forming the metal of which the fastenings are formed with legs or flanges, which, after the fastening has been bent into the T form, are turned down upon (by preference) the inner face of the head, and thereby give strength and solidity to the fastening.

EXACT SIZE.



The probability is that this invention will supersede the use of the ordinary eyelet, which requires tools for making the hole and fastening the eyelet in the papers, and which, when done, cannot be used a second time without destroying the articles fastened. This invention, on the contrary, can be used any number of times, from a few sheets of paper to an inch in thickness, temporarily or for a permanency if required.

GRANTHAM'S HYDRAULIC PRESSES.

FIG. 1

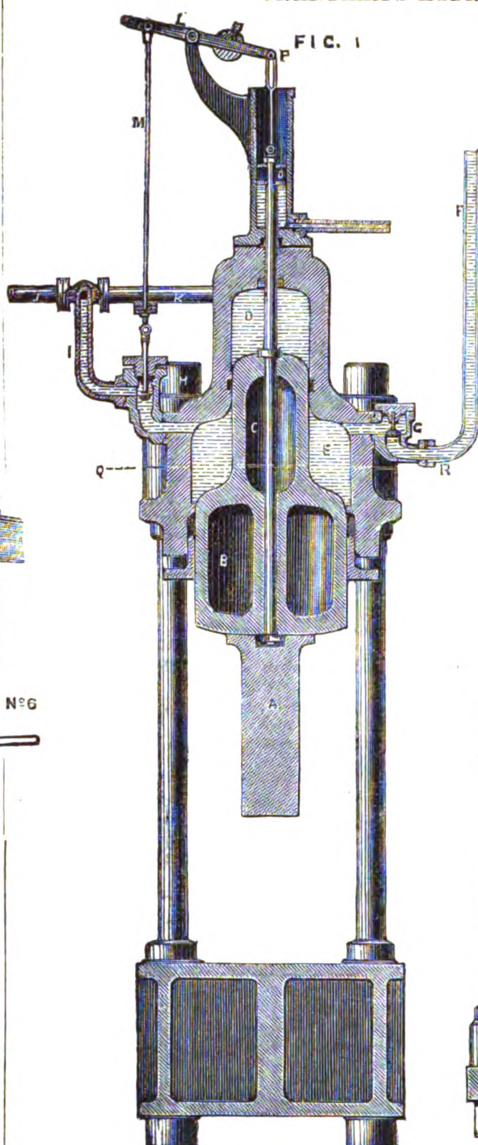


FIG. 4

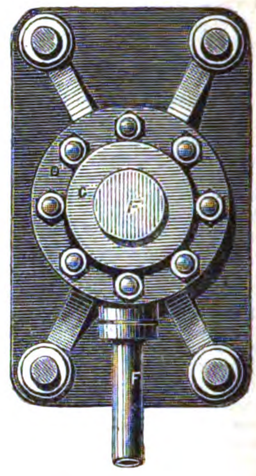


FIG. 3

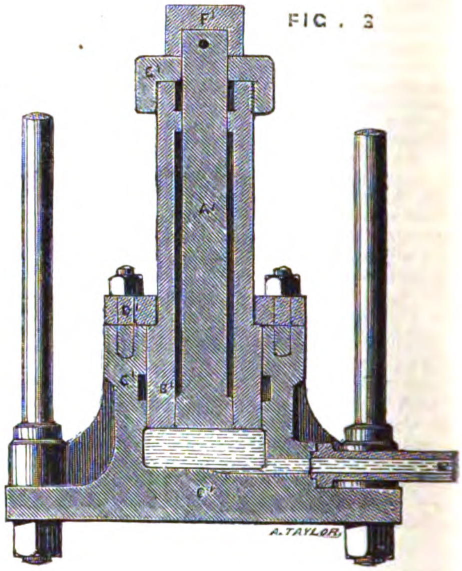
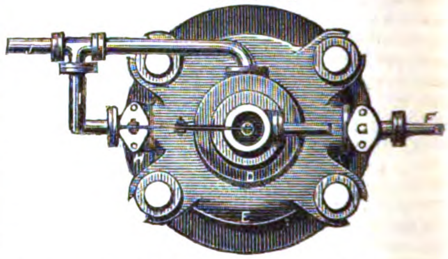


FIG. 2.



GRANTHAM'S IMPROVEMENTS IN HYDRAULIC PRESSES.

The object of this invention, patented by John Grantham, C.E., London, is to vary the amount of power given out by a single ram in a hydraulic press, although the pressure of water or other liquid may be uniform.

The first part relates to an arrangement by which the power exerted by the ram is increased at a certain distance or distances during the stroke, resulting in an economical process for packing or pressing any material into a smaller bulk, and which requires less pressure at the commencement than at the conclusion of the stroke, and especially useful where an accumulator is employed.

In order to effect this object, both the ram and cylinder in which it works are constructed of two or more diameters, each of which is provided with a packing of the ordinary kind. The ram has a telescopic shape, but does not slide within itself; its smallest diameter is first operated upon by the water pressure, by which it is forced to a certain distance, when the next diameter is also operated upon, giving an increased force, and so on to the next, according to the number of gradations in the ram, the power being increased proportionately to the increased diameter of the ram. The spaces between those portions of the ram and cylinder formed during the traverse but not yet supplied with the high pressure, are filled up by means of a flow of water at a low pressure from a pipe fitted with a self-acting valve, which closes immediately the high pressure is turned on, and prevents the water from receding. For the purpose of turning on the water from the accumulator or pumps to the increased diameter or diameters of the ram at the proper time and distance of traverse, a pipe is arranged, communicating either direct with the small end of the cylinder or with a supply pipe, and fitted with a stop valve and lever; this lever may be actuated in any convenient manner by the traverse of the ram, so as to set on the valve as required. Another convenient method for turning on the high pressure of water is effected by forming holes or longitudinal or diagonal slots for a certain distance on the side of the ram, so that when it has traversed such distance the water pressure may be communicated past the packing from the smaller diameter of cylinder to the next of larger size.

The second part of the invention relates to an arrangement in which the power exerted by the ram is greater at the commencement of the stroke than at the conclusion.

For this purpose the ram is made of a telescopic form, consisting of one ram sliding within another, of larger diameter but of less length, the external ram sliding within a cylinder provided with a shoulder or stop. When the pressure from the accumulator or force-pump is applied, it operates upon and actuates both the rams, which traverse together a certain desired distance, until they arrive at the projection or stop, when the pressure actuates only the internal ram, which, being of smaller diameter, exerts a diminished force and requires less water.

Figs. 1 and 2 refer to the first part of the invention, fig. 1 being a vertical section of the press.

A, B, C, is the ram (cast hollow for economy), and having two different diameters; D, E, is the cylinder with corresponding diameters. The part of the ram at C is worked in the cylinder at D, and the part at B is worked in the cylinder at E. A is the ordinary ram for the anvil; F is a pipe communicating to a well or cistern or low-pressure water supply; G is a self-acting valve which allows water to enter the cylinder from the pipe F, but which closes to prevent the water receding as soon as high pressure is applied; H is a stop valve communicated by the pipe I to the high-pressure supply pipe J, K; J communicating in the usual manner to the accumulator or force-pump, and K communicating with the small diameter of the cylinder D; L, M, is a lever and rod with adjustable balance weights, and attached to the valve H; N is a rod attached with the lift O to the ram, and by means of the slot at P actuating the lever and opening the valve at the required distance of traverse. Fig. 2 is a top view.

The process is as follows:—When the ram is

at the top of the cylinder the valve H is closed, the high pressure is set on to the cylinder at D, the ram is forced onward, the low-pressure water filling up the space formed in the cylinder at E. At a certain desired distance of the ram's traverse the rod N moves the lever and opens the valve H, when immediately high pressure is exerted in the cylinder at E as well as at D, closing the valve G, and exerting an increased force on the ram proportionate to the larger diameter of the part B.

Figs. 3 and 4 refer to the second part of the invention. Fig. 3 is a vertical section.

A′ is the small ram; B′, B′, is the larger ram with a shoulder—it is hollow, and fitted as a cylinder to allow the ram A′ to work within it; C′, C′, is the outer cylinder, fitted to allow the ram B′, B′, to work within it; D′, D′, is the stop attached to the cylinder C′,C; E′ is the water supply; F′ is the head to the ram A′; G′, G′, is the head to the ram B′, B′; fig. 5 is a top view of the apparatus. When the rams are at the base of the cylinder C′, C′, the force of the water actuates both rams until the shoulder of B′, B′, impinges upon the stop D′, D′, (which is the position shown in the drawing), when the ram A′ only is in action, and which slides within the cylinder B′, B′, the head F′ separating from the head G′, G′.

WANTED—PURE WATER.

Our sanitary authorities (says the *Building News*) have unanimously accepted pure water as a main feature in the requirements of man. Their effort to secure to the public the necessary element bears testimony to the difficulties that ever arise in a civilized and highly populated country in obtaining water in its state of purity. Pure water has been the cry that has lowered the water company's dividends to an alarming extent to the shareholders. Albeit, the public weal might receive considerable addition therefrom.

Still when we realize the fact, so well established as to be beyond all doubt, that the purer the water that enters our leaden conduits, the more poisonous it may be made before it reaches the consumer, we have to ask most seriously whether or not that great depreciation of stock is not lost, so far as the public advantage that might accrue from it, by the want of a proper knowledge of the medium through which the water is conveyed. A circular was issued, or a general notice promulgated, by the several water companies when the reservoirs were covered in and the various additions and improvements made in compliance with the new Act of Parliament relating thereto, requesting the consumers to clear out their cisterns that they might receive the full benefit of the purer supply. Still it left an equally important requirement untouched and almost unknown. In some districts, puplic attention has been aroused to the knowledge of the requirement of which we speak through the sudden death by poisoning of several members of a family, with the narrow escape of the remainder. The cause has been traced to the leaden pipes through which the water used by the family has been conveyed. We are not about to frighten our readers with a prognostication of sudden death to the consumers of water that has passed through leaden pipes, but ask their attention to a few facts relative to the characteristics of the medium through which they receive this universal element.

Firstly, we are informed by the highest chemical authorities, that pure water so rapidly acts upon lead, that in a very short space of time it becomes impregnated with this metal in a soluble form. Nor are we to escape by the comforting assurance that the water is impure. Water that contains carbonic acid (and what water does not, in a greater or less degree?) equally appropriates to itself a portion of the metallic medium through which it passes; these are facts from which we have no appeal. It is true that water may contain certain constituents that will act on the lead in a manner more favourable to a hygienic state of things, but do we take the trouble to ascertain if such a quality exists in our water? We think not. The result, is, therefore, that in the case of all new lead pipes, colic, next to poisoning, is the result upon all who use it; and in all cases, unless specially protected, poison, in the form of salts of lead, is administered, whether in homœopathic doses or after the more liberal allopathic system, and a deleterious effect is produced upon the system and health of all who partake of the liquid. The effect of sulphuric acid as a corrective, in the exceptional cases of which we have already spoken, is caused by the internal surface of the lead being changed from the metallic state into a sulphide of the metal which is insoluble in water. This reaction may be artificially produced by a simple yet highly scientific process, the discovery of Dr. Schwarz, of Breslau. This *savant* proposes the passing through lead pipes of a solution of sulphide of potassium, at a temperature of 212 deg., which changes the metallic lead into a sulphide of lead, and, thus transmuted, the water passing through it is perfectly free from the risk of contamination by any poisonous salt from the lead. It remains for the public themselves to decide, from our statements of facts, whether or not they will continue to tolerate even the skeleton of an evil that may be so easily exorcised.

MANCHESTER BOILER ASSOCIATION.

At the last ordinary monthly meeting of the Executive Committee of this Association, held at the Offices, 41, Corporation-street, Manchester, on Tuesday, September 29, 1863—William Fairbairn, Esq., C.E., F.R.S., in the chair—Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

During the past month there have been examined 319 engines and 471 boilers. Of the latter, 4 have been examined specially, 4 internally, 49 thoroughly, and 414 externally, in addition to which 1 of these boilers has been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture, 5 (2 dangerous); corrosion, 16; safety valves out of order, 2; water gauges ditto, 20 (1 dangerous); pressure gauges ditto, 10; feed apparatus ditto, 2 (1 dangerous); blow-out apparatus ditto, 14; fusible plugs ditto, 8; furnaces out of shape, 1. Total, 78 (4 dangerous). Boilers without glass water gauges, 3; without blow-out apparatus, 21; without back pressure valves, 17.

Explosions.

Three boilers, not under the inspection of this Association, have exploded during the past month, from which four persons have been killed and three others injured. One of the boilers has been personally examined since the explosion, while this was prevented in the other cases by distance.

The first explosion, from which one person was killed and two others injured, happened to an agricultural boiler, while at work at a farm, driving a thrashing machine. It was not under the inspection of this Association.

The boiler, which was about twelve years old, was a portable one, of the multitubular locomotive type, and was worked at a pressure of about 40 lbs. per square inch. It was stated at the inquest that the safety valve worked freely, and that there was a due supply of water, the explosion being attributed entirely to a defective plate in the fire-box, which had been eaten away by corrosion, until reduced to one-sixteenth of an inch in thickness. This plate had been previously repaired, and at the time of the explosion was cracked through, and though it had for some days been leaking in consequence, had yet been worked on in that state.

The owner of the boiler was brought in guilty of manslaughter, the jury adding that they thought the appointment of a Government inspector to be highly necessary.

The second occurred to a new balloon or haystack boiler during the operation of testing at the maker's yard. It had not been constructed for raising steam for purposes of power, but was intended to be used as a chemical evaporating pan or still. It was not under the inspection of this Association.

The boiler—as another of similar construction and dimensions had recently been—was proved with steam, in order to test the tightness of the joints. The pressure, which appears to have been about 50 lbs., being raised, not by generating the steam within it by means of a fire underneath, but by communication with another boiler in work, to which it was temporarily connected for the purpose. Some five or six men were engaged upon it in caulking the seams at the time of the explosion, four of whom were blown to a distance from it; one of them, who was killed upon the spot, being thrown upon the roof of a house about 40 yards off, while two others died subsequently from the injuries received. The boiler was laid upon its side during the test, and gave way at the bottom, which was blown out entire, and thrown upon a roof about 10 ft. high and 13 yards distant, the shell rearing up on its dome end, and remaining in that position supported by a shear leg.

Its dimensions were as follows:—The height was 11 ft., the dome, from the appearance of which the term balloon boiler probably arose, was 9 ft. 3 in. in diameter, and the base 8 ft. 9 in., while the cylindrical sides were drawn in to 7 ft. 9 in. in the waist. The bottom, like that of a bottle, was concave, as is usual in these boilers, and rose 18 in. at the centre, in order to enable it to resist the downward pressure, being connected to the sides of the shell by a 3-in. angle iron, half an inch thick. The plates, which were from seven-sixteenths to half an inch in thickness throughout, were some of them second-hand, those forming the dome being new, the remainder having been used in a boiler before. They had, however, been worked to their new shape, their edges sheared, and the holes punched afresh. The rivets, which were three-quarters of an inch in diameter, were centred from $1\frac{1}{4}$ in. to 2 in. apart, and the general workmanship appeared satisfactory.

The rent between the bottom and sides of the boiler had occurred, for the most part, at the lower ring seam of rivets in the cylindrical portion of the shell, but not altogether so, some portion of the rent running through the rivet holes at the outer edge of the circular bottom plate; while, from the upward position in which the latter was thrown by the explosion, it appeared most probable that the rent had commenced at that part of the boiler which lay nearest the ground at the time of the explosion, and thus, from the position of the fractures, must have started at the cylindrical part, and not at the bottom plate. The reason of this is not very apparent—since there were two other ring seams of rivets in the cylindrical portion of the boiler which were quite uninjured, although subjected to the same direct pull, which, after allowing for the rivet holes, did not amount to two tons per square inch of metal, added to which, the longitudinal strain thrown upon these circular seams in cylindrical boilers, is only half of that which occurs in the transverse direction, so that it is difficult to account for the rent selecting the lower ring seam of rivets, or indeed for its occurring at all.

Whether, however, the rent in question was due to some undetected flaw in the iron, or whether the plates had been crippled in being brought together, which is too frequently the case, or whether an unfair strain was caused by the springing of the eighteen bottom plate, which, although arched eighteen inches in the centre, was yet flat as compared with the hemispherical top; or whatever may have been the cause that started the rent, one thing is certain—that the application of the hydraulic test would have detected and exposed the weakness, prevented the explosion, and saved the three lives. It is, therefore, again earnestly recommended that in all similar cases this precaution should be adopted; and it is trusted that it will not be necessary for any further additions to be made to the list of fatal explosions—already sadly too long—before the adoption of the simple and inexpensive hydraulic test becomes universal.

Cavalier Novi, formerly Lieut.-Colonel of the Ordnance, on the 5th of February last, read at the Royal Institution of Naples a Paper entitled "Substances for the Preservation of Iron, Cast Iron, and Steel." It was approved and inserted in the reports of the Academy. After having enumerated the principal means for preserving iron adopted by the ancients, and still more recently down to modern times, he confines his attention to the three following compositions for coating iron works:—1. Varnish composed of resinous matter, such as essence of turpentine, galipot, resin, colophony, &c. 2, varnish in the composition of which there is; quick essence of coal tar and dry pitch of the same tar; 3, varnish the composition of which is derived from asphalte and its quick essences, mixed with oxides and various colouring substances. He concludes by saying that the future preservation of iron depends on the positive use of asphalte and its results. In the month of August the French Government directed that experiments should be made on these compositions.

LAW AND DOWNIE'S TRACTION ENGINES.

Fig. 1.

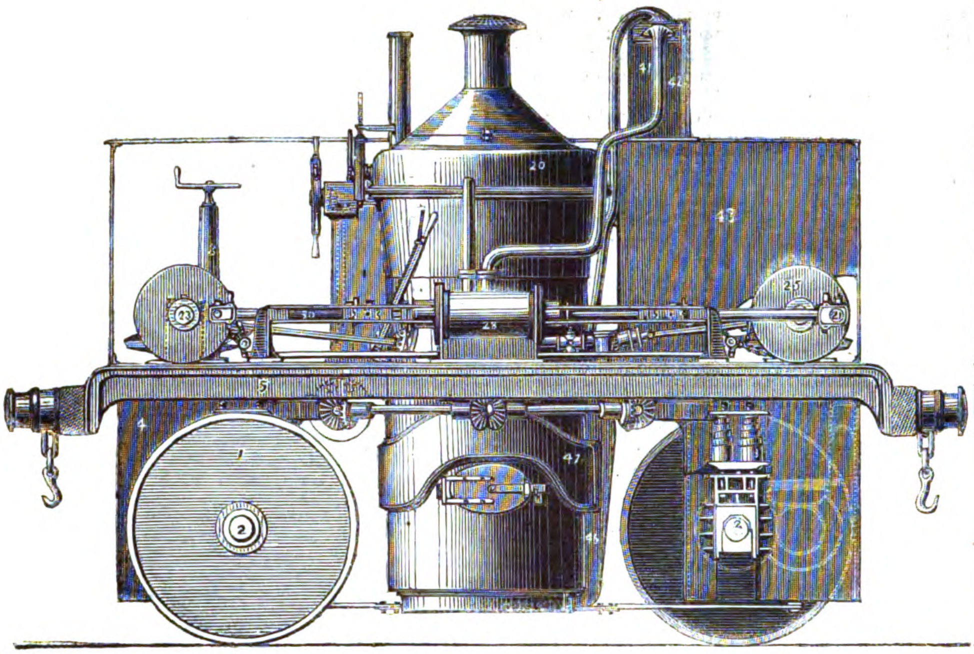
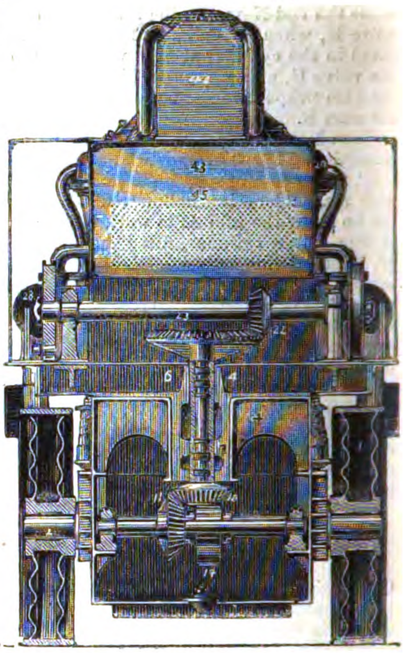


Fig. 2.



LAW AND DOWNIE'S TRACTION ENGINES.

The following improvements in traction engines have been patented by Messrs. Law and Downie, engineers, Glasgow.

This invention has for object increased efficiency in traction engines, with economy in cost and facility and convenience in manœuvring.

Fig. 1 is a front elevation of one modification of the improved traction engine, with the outer shell or casing removed, to show the details in the interior, one of the wheels being also supposed to be removed to show parts that would have been hid by it; and fig. 2 is a transverse vertical section.

In this improved traction engine there are two pairs of carrying or main driving wheels, and an important feature is the making of all four wheels both driving wheels and steering wheels. The steering is effected by inclining the axles horizontally in opposite directions, the axles being driven by gearing arranged so as not to be interfered with by this inclining of the axles. Each pair of wheels has mounted on it, on springs, a kind of bogie; and the two bogies support the main carriage framing, and are connected thereto so as to be capable of swivelling for the steering action already referred to. The main carriage framing is, in this example, a kind of platform built up with longitudinal and transverse wrought-iron ribs or beams placed vertically, and strengthened by angle irons, being covered by floor plates. At each end there is built into the wrought-iron framing a cast-iron ribbed frame-piece, which bears in each case upon the corresponding bogie, or this framing may be entirely of wrought iron. Each end frame piece is formed with a tubular trunnion 7 projecting downwards, and on which the bogie swivels, being made with a socket to fit and turn upon it. In the vertical axes, about which the bogies 4 swivel, that is, in each case in the tubular trunnion, there is a vertical shaft 8 fitted with a bevel wheel 9 on its upper end, and with a bevel pinion 10 on its lower end. The bevel pinion gears with a bevel wheel 11 on an intermediate horizontal shaft, mounted in bearings in the bogie, with which arrangement the swivelling of the bogies for steering purposes merely causes the bevel wheels to, as it were, roll round the bevel pinions 10 on the vertical shafts without affecting the transmission of the power through the wheels. The intermediate horizontal shaft 12 of each bogie is fitted with a spur pinion, which gears with a spur wheel 14 fast on the main driving wheels' axle, and this spur pinion 13 is, by preference, directly under the swivelling centre of the bogie, or as near thereto as can be conveniently managed, and is made with the teeth slightly curved across their acting faces, so that the teeth are slightly thicker at their middles, with which arrangemnt the carrying wheels 1 and axle 2 can accommodate themselves to inequalities of the road without disturbing the engine or gearing. The axles 2 are arranged with axle boxes and springs 3 in a manner similar to that sometimes adopted in railway rolling stock. The bogies 4 are made to swivel, as required for steering purposes, by means of toothed segments, fixed upon them, and acted upon by worm wheels, and one of the worm-wheel shafts is connected by bevel gearing with a hand wheel, mounted upon a standard, whilst the two worm-wheel shafts are connected by intermediate shafts and bevel wheels, so as to be actuated simultaneously. This gearing is arranged to turn the bogies in opposite directions, whereby a doubled steering efficacy is obtained with a given adjustment, whilst, from the swivelling wheels being at the same time driving wheels, the steering action is thereby rendered the more certain and powerful.

Various arrangements of steam boiler and engine details may be provided for driving the apparatus which has been described. In one modification, a multitubular boiler, of the vertical class, is employed, and this boiler may be suspended by trunnions, as shown in fig. 4, so as by its own weight to remain vertical, although the carriage may be ascending or descending an incline. The boiler 20 is placed centrally and between the bogies and their vertical driving shafts 8, being fixed to the main framing 5 by flange plates or brackets (which are not shown). The vertical shafts are actuated by bevel pinions upon transverse horizontal shafts, mounted in bearings upon the platform or main framing. The transverse horizontal shafts are at each end fitted with overhung discs 25, provided with crank pins, whereby they are driven by means of two steam cylinders 28, arranged on the main framing, one on each side of the boiler. The pistons are fitted with long piston rods, working out at both ends of each cylinder, and having both ends fitted with slide blocks working in guides and jointed to connecting rods, which are jointed on the several crank pins. Any other convenient arrangement of the steam-engine details may be adopted in place of that described. Frictional brake straps 31 are applied to the four crank-pin discs 25, being arranged to be actuated simultaneously, and giving the power of bringing the machine to a dead stop in a very short space. The brakes are actuated by means of a vertical screw spindle, fitted with a handle, and mounted in a pillar. The screw spindle acts on a lever fast on a transverse horizontal shaft, which acts directly on the brake straps at the end, and simultaneously, by means of rods, on the brake straps at the other end. The steam cylinder valves are worked by means of the ordinary reversing link-motion 36, and the eccentrics are conveniently placed on one of the crank shafts, whilst on the other crank shaft are placed eccentrics for working the feed-pumps.

The several arrangements which have been described permit of the centre of gravity being kept low, and with the centres of the wheels closer together than usual with other plans, whilst extreme portability and compactness is ensured. The two ends of the engine are reversed duplicates of each other, whence arises economy and simplicity in construction, whilst the engine may move in either direction with equal facility, whereby the frequent necessity of turning will be obviated.

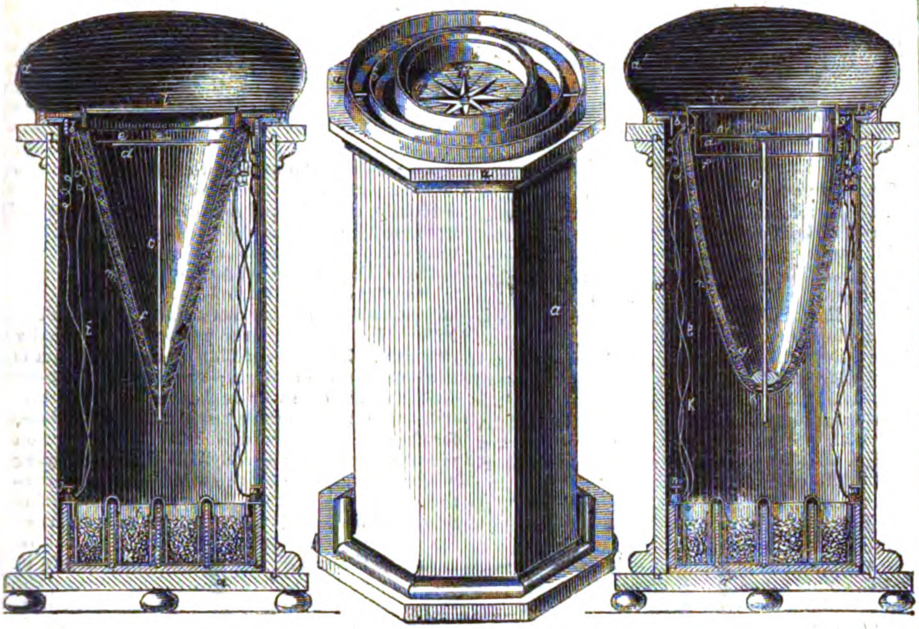
The details described are obviously susceptible of various modifications, and the invention also comprises improvements in other details; thus the engine may be fitted with more than two pairs of wheels, and every pair or only two pairs may be made driving wheels. The engine may also be made to carry a load, or it may be arranged to transmit driving power to the wheels of one or more lorries or waggons coupled to it. The engine may also be fitted with a crane or with other hoisting or winding details to be driven by hand or by engine power.

It is intended in general to provide the usual blast pipe and steam jet in the chimney to assist the furnace draught; and in addition to these appliances, provision is made for exhausting the waste steam from the cylinders into the feed-water tank through a box fitted with divisions of wire cloth, or the like, to suppress the sound and the external appearance of white vapour, and at the same time to heat the feed water.

The modification of engine shown in figs. 1, 2, and 3 is represented as provided with these im-

GISBORNE AN SIMPSON'S SHIPS' COMPASSES.

Fig. 1. Fig. 2. Fig. 3.



proved arrangements. The exhaust pipes 41, from the steam cylinders, are made to communicate with the top of a box 42, placed on the top of the water tank, with which tank the bottom of the box 42 is in open communication. In this box there are placed a number of horizontal diaphragms of wire gauze, through which the exhaust steam has to pass, noise being thereby prevented, and the steam more or less condensed, whilst it imparts heat to the feed water. To render this action the more efficient, branch pipes, with which the feed-pumps may be put in connection when not feeding the boiler, are carried from the feed-pumps, and unite in a single pipe, which discharges the water into the top of the box 42, and the water falling like a shower through the wire gauze diaphragms, and carrying along with it the steam, promotes its partial condensation, thereby rendering the necessity for supplying the feed tank less frequent than in ordinary arrangements. Further, as the heat imparted to the feed water is considerable, a number of tubes are fitted longitudinally across the tank, and air entering these tubes at their outer ends tends in passing through them to keep down the temperature of the water for circulating purposes. From the tubes the air passes into a duct 46, which communicates with the ashpit and with a belt, which encircles the boiler above the grate bars, the air being admitted into the furnace from this belt by tubes which cross the water space surrounding the furnace. A donkey-engine feed-pump is provided as usual for feeding the boiler when the main engines are not working, and can also be used when the engines are working to keep up circulation in the feed tank, by withdrawing water from the lower part and discharging it into the condensing box 42. This pump is also provided with connections to enable it to be used for drawing water from a road-side stream or trough to supply the water tank, and thereby rendering special watering stations unnecessary. Where rapid manœuvring is required, the donkey-engine may be arranged to supply power for working the steering details, the steersman in that case having merely to set levers or hand wheels for putting the necessary motions into or out of gear, or the steering gear may be worked by a special cylinder or pair of cylinders, the action of which may be regulated in various ways; thus, by one plan the steersman by turning the steering wheel actuates the valves of the cylinder or cylinders, which last actuate the steering details in a precisely correponding direction and degree.

GISBORNE AND SIMPSON'S IMPROVEMENTS IN SHIPS' COMPASSES.

This invention, patented by T. S. Gisborne, E. E., Birkenhead, and Mr. W. Simpson, of Liverpool, consists of the use or employment of electricity, to render insensible to local attraction, or to overcome or countercheck the local influences which have so often and so seriously affected the magnetic needles in ships' and other compasses. And although this invention is more particularly serviceable in compasses to be used on board ship, it is not exclusively so applicable, as it may be applied or used to or with other compasses.

The best mode or arrangement for "the employment of electricity" for the purpose above named, consists in passing a current of electricity from an ordinary battery through a coil of insulated copper wire wound around a hollow conical or semispheroidal compass box, or wound around a hollow conical or semispheroidal-shaped dish encircling the compass box. In either of these arrangements the magnetic or compass needle rests on a centre pin; or when there are more than one, they are secured to the card or other part, which rests on the pin in any usual way, at a short distance below a straight line drawn horizontally across the upper termination of the coil and below the mouth or termination of the conical or semispheroidal-shaped box or dish, the leading features of construction of compasses at present in use being retained.

In figs. 1, 2, and 3 of the accompanying drawings, the same letters of reference denote the same parts. *a* represents the binnacle; *b*, the compass bow; *c*, the pin for carrying the needle *d* and card *e*; *f*, the compass box, made of sheet copper or other material into the shape shown and supported on gimbals *g*, as in ordinary compasses. On the outer surface of the said conical compass box *f*, there are fastened, by soldering or otherwise, a number of projecting pins or pieces *h*, which keep the insulated wires *i* in their places around the compass box *f*. The insulated wires *i* are here shown to be two in number, but one only, or any larger number, may be employed; at *j* they are connected, after sufficient slack has been left for free movement of the compass to, and communicate with, the battery *k*, shown as of the ordinary sand or sulphate of copper description, although any other kind of battery or means of maintaining a continuous current of electricity would answer the same purpose. The currents of electricity may be made to travel in any direction; but in practice it is advisable, indeed almost indispensable, that the currents should pass around the cone, and consequently around and below the magnetic or compass needle or needles in opposite directions—that is, the layer of insulated wire next the cone may have the electricity passing in one direction, whilst the layer over it may have the electricity passing in the opposite direction, or two insulated wires with the positive end of one and negative end of the other laid together may be taken and wound around the cone. *l* is the glass cover; *m*, shows a protecting covering of gutta percha or other material, preferably impervious to moisture.

To arrange or set either of the apparatus above described for use, it is only necessary to connect the wires to the battery, when, if the insulation is good, a continuous current of electricity will pass from one pole of the battery to the other through the coil, and in so doing the effect is to counteract practically all local attraction of the magnetic needle or magnetic needles in ships' and other compasses, and give a "true north pole."

SOUTH WALES INSTITUTE OF ENGINEERS.

The annual general meeting of the members of this Institute was held at the theatre of the Royal Institution, Swansea, on Saturday last—the President, T. Evans, Esq., F.G.S., and Government Inspector of Coal Mines for the South Wales District, in the chair. Lionel Brough, Esq., the Inspector for the Bristol and West of England District, and about fifty other members of the Association, were also present.—The President, in opening the proceedings, observed that six years had passed away since the promoters of the South Wales Institute of Engineers met together at Methyr and held their first meeting in that great centre of mining and manufacturing industry. They were but few in number, inexperienced in the conduct of such matters, and labouring under innumerable difficulties. Those difficulties, however, had been surmounted, and their numbers had increased far beyond their expectations, and he could now designate the Institution as a most important and flourishing body. During the past year, however, death had been amongst them, and they had now to deplore the loss of three most valuable members—viz., Mr. Ebenezer Rogers, of Abercarne (one of the early promoters of the Institution), Mr. Benjamin Dodd, of Blaenavon, and Mr. Samuel Baldwin Rogers, of Chepstow, the inventor of the iron bottom in the puddling furnace, which had proved of such incalculable benefit to the iron trade.—The Secretary having read the report for the last year, the members proceeded to the discussion of Mr. William Firth's Paper on "Coal-cutting by Machinery," this subject is at present creating considerable interest amongst scientific men, and several of the learned associations of the day are discussing the feasibility of adapting machinery to cutting coal. The writer of the paper in question is an advocate for the introduction of the coal-cutting machine, and minutely describes that in use at West Ardesley colliery, near Leeds. The motive power is compressed air, and the machinery so simple, that it is but little liable to derangement. One penny per ton will amply cover wear and tear of machinery, interest, and redemption of capital, on a daily get of 500 tons. The get of large coal by machinery over manual labour was also most satisfactory, and a total saving of 7d. per ton was realized. Upwards of 40 per cent. of the loss of life in coal mines arises from falls of coals or roof. The introduction of machinery will reduce the number of persons exposed to these casualties at least one half, and consequently a considerable saving of life must result.—During the discussion which ensued, Mr. Brough, Mr. Bedlington, Mr. Birkbeck, and others, believed that the proper power for propelling machinery under ground had at length been discovered, and that coal-cutting machines could be advantageously used in the North of England, where there were good roofs and good bottoms, and where the wages for cutting were very high. They, however, questioned the use of such machines in the South Wales mines, where the roofs and bottoms were bad, and where wages were low. They believed also that the loss of power would be very great in collieries of large extent; and what was still more objectionable to the introduction of these machines in Wales, was that the pick was driven with such force that, if it came in contact with pyrites, it struck fire, which was very dangerous in fiery veins like those of Wales. The members generally seemed to admit that the first great difficulty, the propelling power, had been

successfully overcome, as, mechanically speaking, the engine answered every purpose, and they hoped the day was not far distant when the other obstacles would be removed, and coal-cutting by machinery universally adopted, resulting in a great saving of human life.—The following Papers were then read, and ordered to be printed for discussion at the next meeting :—"On surface condensation, and the use of distilled water in boilers," by Mr. Turner, of Lansamlet, near Swansea; "Description of a mode adopted in sinking a pit through quicksand," by Mr. John Glassbrook, of Morriston, near Swansea; "On long work in collieries," by Mr. John Williams, of the Letty Shenkin Colliery, Aberdare; and "On coal and ironstone mining in Scotland," by Mr. Ralph Moore.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—F. W., G. W., G. P. W., R. D., W. G. and Co., W. W., Capt. N., R. T., J. N., G. L. W., W. P.

H. H. A. (Birmingham).—All the registered designs appear in our pages. But few have appeared recently. The next list will appear in a week or two.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Living in a colony, I am, like most others of my calling, often put into unpleasant straits by want of carriage for my produce to the seaboard and supplies to the estate.

Do you think a road engine would be of any assistance? The distance to the port of shipment is 96 miles—the road, as a rule, fairly good, but over a pass of 1,500 ft. above the general level of the country, and a small portion, on each side, at a very steep gradient (say 1 in 8 or 7), but only for 200 or 300 yards. There are also two or three sharp corners to turn. Mail coaches with passengers run the whole distance at an average speed of eight miles an hour. I should, when I could get them, have to carry my own coals; at other times, wood must be the fuel. Coals average about £3 per ton at the port. Carriage by bullock-carts ranges from £3 3s. to £5 15s. per 16 cwts. Occasionally it goes to double and treble this last rate, but that is very unusual. An Englishman would, of course, be required as driver. Now the questions I should like to put to you are:—

Would any description of road engine be economical; and would it be possible to get one that would not, with fair treatment, get out of order? If so, what makers would be to be preferred, and what guarantee should I have that it would not fail on the first or second journey, and thereby entail a heavy loss?

What would be the price of such a machine, on board, with duplicate parts most likely to fail?

Would a copper boiler be worth the extra cost?

Allowing 20 per cent. for wear and tear, at what rate per ton per mile should I get it to draw loads? By wear and tear, I mean fair wear and tear, exclusive of breakages and accidents, for which a liberal allowance ought to be made.

In case of your handing this over to any manufacturer who might like to speculate to the extent of the postage of a priced list and description, I add my name and address, but remain to you as

Your obedient servant,
PLANTER.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

"THE GREAT EASTERN."

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Long ago I recommended in your columns two screws to be placed one on each side of the rudder-post to facilitate the steering of this vessel. This the daily papers have lately described as having been tried successfully in another steamer. It now appears also the mountainous paddles become injured in a stormy sea. Permit me to suggest that they be removed altogether, placing instead three paddles with their appendages on each side. This could be done with present steam engines, with the addition of shafts, cranks, and lower bearings than the present ones. The steerage power of the "Great Eastern" would, with this alteration, be equal to any conceivable emergency, as the paddle abaft midship on one side could be reversed, whilst the forward paddle on contrary side is working onwards. Besides, with any sea one of the sets of paddles would be working efficiently.

Yours truly,
GEORGE WALCOTT, C.E.

STEAM BOILER EXPLOSIONS.

SIR,—In your last impression I observe that Mr. Clark refers the origin of the "projectile theory" of boiler explosions to a private conversation between himself, my friend Mr. Holley, and myself, on some day not named, but "shortly after" the explosion on board the "Great Eastern." Mr. Holley was on board the ship at the time of the disaster—viz., 5.50 p.m. Friday, September 9th, 1859, and narrowly escaped with his life. Before quitting the vessel he made himself thoroughly acquainted with the structure and fittings of the feed-water casing, and with the conditions under which it had worked. He returned to town the next (Saturday) evening, and came immediately to my rooms. With the light which he gave me, I at once formed an opinion of the cause of the explosion. I saw that the casing must have been nearly full of water just before it exploded, and that the funnel, having no stays, must have collapsed under a moderate pressure. In collapsing, some of the joints would be likely to open, and thus the steam, pressing upon nearly eleven tons of water heated, perhaps, to 300 deg., would be instantly liberated. As to what would be the result, I immediately formed the opinion I have ever since held—an opinion which, as I believed, was clearly expressed in a leader in the *Engineer* of the following Friday. My views were formed on the evening of September 10th, 1859; and Mr. Holley, who adopted them in his letter to the next number of the *Engineer*, understood and shared them with me at the time. We met Mr. Clark a few days afterwards and I mentioned my view of the case to him. He offered some explanation of his own—one which I was unable to understand at the time. On a subsequent occasion he appeared to agree with me; but he has since advanced an explanation (one which, possibly, may have been that which he suggested in the presence of Mr. Holley and myself), and which, now that I do understand it, I dissent from altogether. I may add that Mr. Holley is now in England, and that Mr. Clark can easily refer to him should he wish to do so.—I am, &c.,

ZERAH COLBURN.

SIR,—It appears to me to be rather an idle discussion, whether Mr. D. K. Clark or any other man originated that particular theory of the violence of boiler explosions which that gentleman advocates. The theory in question insists on the projection of the water and its percussive action as being the prominent agency in the production of violent effects. Now every man who has drawn the cork of a bottle of ginger beer recognises and understands this action. The fact itself is plain enough, and the only novelty in the application and *rationale* of the thing is the distinction which Mr. Clark makes between the momentum of the steam and the momentum of the water projected, contending that the latter, as "a heavy projectile" . . . "shatters the boiler in a manner not to be accounted for by simple over-pressure or by simple momentum of steam." Now this distinction would be relevant to the subject, and the conclusion drawn therefrom of "the sudden projection of the water in the boiler being the great cause of the violence of the effects," would be perfectly correct, if the water were projected with the same velocity as the steam. This, however, is not the fact, but it is covertly assumed as such; and as a condition for consistency of thought, it must have underlaid all Mr. Clark's ideas on the subject.

On the 3rd and 10th of May 1861, Mr. Clark addressed you on this subject; and on the 17th of the same month you published a communication of mine in which the fallacy here adverted to was fully exposed. No reply was made to it; and I thought, therefore, that my reasoning was satisfactory, and the refutation unanswerably complete. But error possesses great vitality, and comes to the surface again and again. Will it be out of place then to re-state, in brief terms, the argument which on the former occasion I employed—namely, that if a given repulsive force imparts motion to bodies which differ in their mass, the respective velocities will be inversely proportional to the masses, that is to say, in the inverse ratio of their specific gravities; consequently, a particle of steam and a particle of water will impinge on the broken and separate pieces of the boiler with no grater momentum, the one than the other? I speak of the fragments of the boiler, for, of course, no projectile and percussive action can take place until the boiler by simple over-pressure is actually ruptured. But this equality in the momenta is truth only in the abstract; and the practical conditions of the case will make the actual result still more unfavourable to Mr. Clark's notions, for the said particles will have to impinge on pieces of the boiler already in motion, and flying with a velocity due to the pressure that causes the explosion, which velocity, if the magazine of steam be large, may well be greater than that which the necessarily lesser pressure, now acting on the water, will be able to impart to it. So that possibly, according to circumstances, the water may have no projectile action at all on the fragments of the boiler. At any rate, it could only act with its relative velocity. Now that relative velocity is immensely in favour of the steam, by reason of the immense difference in the absolute velocities imparted to the steam and to the water. Again, in the case of the water, we have to take into account the time lost in consequence of the secondary character of the action upon it of the repulsive force, during which the fragments of the boiler have already been projected by the primary action of the force, and have gotten the start of the water.

But, in opposition to Mr. Clark's notions, I imagine the real fact is, what the Astronomer Royal, in his recent communication to the British Association, assumes it to be—that the second action of the force is the conversion of part of the water into steam, which, of course, will further delay the projection of the remainder, through the instrumentality of the steam so produced; thus constituting the third action of the force in the order of time. For as to any inherent projectile force proper to, and operating on the remaining water, it will be altogether robbed of that by being robbed of its heat. Thus, in Mr. Airy's opinion, the entire destructive energy of the explosion resides in the steam, in its conjoint action simultaneous with and subsequent to the rupture of the boiler—a conclusion to which the common sense of observers has all along directed them. There is nothing new in the observation; but Mr. Airy has endeavoured to give some precision to the estimate of the remanent force in the steam liberated from the water by the explosion. It is, however, more specious than real, and this is a qualification which necessarily attaches to all mathematical estimates of practical matters in the abstract; and yet there is a charm, as well as an illusion, in obtaining precision and certainty, although it be only in the abstract.

The practical points which are not amenable to calculation, but which have an influence upon the effects—and it is here where precision and certainty have any importance at all—pertain in part to the secondary nature of the action of the force in its evolution from the water, for it is in time that it follows the first, and it takes other time in the extrication of the steam. These are circumstances connected with the physics of the subject, and the mathematician cannot fix and determine such; they are dependent too, in degree, on other circumstances of a practical kind. Now, time is the all-important element in the efficiency of steam as a destructive agent, and yet we are unable to bring it to account. We may arrive, even in an explosion, at a tolerably satisfactory estimate of the efficiency of steam, as a

cause, in the aspect of mechanical power, labouring force, or energy, as it is now the fashion to call it; but that is of no avail unless we can supplement the time. The work done will be the same, although it should take a moment or a month in the doing, but the destructiveness of percussion does not follow that rule. A cubic foot of water at 60 lb. pressure of steam, is found by Mr. Airy to be equivalent to 1 lb. of gunpowder, but both the one and the other may be very harmless under a slow development of their powers. In this comparative estimate, by-the-bye, the "*accurate* integration" concerning the one is mixed up with a mere guess at the destructive energy of the other, the loss thereof in Didion's experiments being *supposed* to be *one-half*. Verily, mathematical accuracy and precision are fain at times to put up with a very incongruous kind of companionship. The truth is, that the power of the science for all practical affairs is bounded within exceedingly narrow limits, and the sole recommendation, generally speaking, of mathematical conclusions concerning them, is mathematical *prestige*.

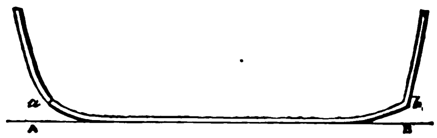
Yours, &c.,
Sept. 28. Benj. Cheverton.

SHIPS' WATER-MARKS.

Sir,—As the Mechanics' Magazine is extensively read by naval architects, and others connected with our mercantile marine, it may prevent an accident of a very serious character if you publish the following caution respecting the "*water-marks*" placed on ships' stems and stern-posts.

I have seen several vessels with their keels "cut up" (as it is technically called) at their stems and stern-posts, and their water-marks, in consequence, have given an erroneous indication of their draft of water.

Let A B be a straight horizontal line continued



forward and aft along the base of the keel. The keel being "cut up," that is, curved upward as at *a* and *b*, the water-marks are placed so as to show the draft of water above *a* forward, and *b* aft; instead of showing it above the line A B.

The consequence is that, when a ship so marked is about to be placed upon blocks in dry dock, the captain may be oblivious or ignorant of the keel being so cut up at its two ends, or at either of them, and the ship may actually draw a foot more water than she appears to draw.

Within the last few days, a ship of this kind was being hauled into dry dock. The water indicated upon the beacon at the head of the blocks, was considerably more than the ship apparently required, and abaft there was a still greater superabundance. But, before the ship could be placed in her intended berth, she stopped, as the men were hauling her to it; and some of the blocks making their appearance on the surface of the water it was manifest that she had pressed upon those blocks and tripped them. Considerable force was required to get the ship clear of the blocks, and if this had not been effected, she would have grounded upon them in such a manner, in all probability, as to have strained and broken herself very seriously.

Nauticus.

Miscellanea.

A monument to the memory of the late Samuel Colt, the inventor of the revolver, is to be erected at Hartford, Conn., of Scotch granite. Mr. J. G. Butterson, of that city, the designer of the Worth monument, New York, has gone to Scotland to select and purchase the granite. The monument is to cost 25,000 dols.

A French engineer has made an improvement in making macadamized roads that promises good results. The main feature of the invention is a steam roller, to consolidate gravel and broken stone. A pair of cylinders, inclined at 49 degs., act on an outside crank on one end of the axle of the main roller or drum. The front axle has broad wheels, and is controlled by steering gear similar to that used on steam carriages and traction engines. This machine can run both backward and forward with equal facility, is easily reversed, and can work on a short piece of road until sufficiently consolidated.

We learn that the Plymouth Iron Works, at Merthyr Tydvil, to the creation and improvement of which the late proprietor, Mr. Anthony Hill, devoted a valuable lifetime, have recently been purchased from his trustees for a quarter of a million sterling by three gentlemen whose acknowledged experience, ability, and command of capital will, doubtless, maintain and increase the well-earned reputation of the works. The purchasers are Mr. Richard Fothergill, of the Aberdare Iron Works; Mr. Thomas A. Hankey, banker; and Mr. Benjamin Bateman, iron merchant. The property of which they have become possessed comprises 3,000 to 4,000 acres, abounding in steam coal, ironstone, limestone, &c., sufficient for a produce of iron nearly double the present make. About 6,000 tons of coal are raised weekly, and this quantity may be very considerably increased. The works are remarkably well situated as regards water power, and the machinery and appliances are of the most extensive character. There are eleven blast furnaces, producing about 1,000 tons of cold-blast pig iron weekly, as well as forges, rolling mills, &c., equal to the production of about 800 tons of finished iron weekly.

Workmen are now busily engaged in making the excavations in Seymour-street, for the extension of the pneumatic despatch from the Euston Station of the London and North-Western Railway to the General Post-office in St. Martin's-le-Grand, and to Messrs. Pickford's depôt in Gresham-street. The total additional distance between Euston-square and the City will be 2½ miles, making with the distance between the North-Western District Post-office and Euston-square, now in daily operation, a length of 3½ miles. A 54-inch tube, instead of 30-inch, is now being constructed, and it is expected that the line may be so far completed for the transmission of the Christmas traffic into the City from the London and North-Western Railway at that period.

The iron trade in the North continues to improve. There are at present 125 furnaces in blast, producing about 21,500 tons weekly. The total deliveries continue steadily in excess of the make, and will be this week fully 25,000 tons. Consequently the stocks are about 35,000 tons less than they were four months ago. The malleable ironworks, foundries, and shipbuilding yards on the Clyde were never so actively employed and so full of orders. So great is the demand for iron for shipment and local consumption, that ironmasters have raised their prices 2s. to 3s. per ton.

At Woolwich, an experimental 300-pounder Armstrong gun, after being fired nine times, was found defective near the muzzle, in the same way as many of the 12-pounders.

The French Minister of Commerce, having recently sent to the Rouen Chamber of Commerce specimens of the Siamese nettle or China hemp in various states of preparation, experiments have been made to ascertain its value as a textile substance. The result, as announced by the Chamber, is that, when mixed with cotton in the proportion of one half, excellent yarn may be produced at a cost of 30 per cent. cheaper than from Louisiana cotton at its present price. The Chamber calls the attention of manufacturers to this important fact, and requests them to inspect the specimens placed at their disposal.

There has been a great decrease in the exports of coal from the various ports of the Kingdom during the past month. As compared with the corresponding month of 1862, the decrease is as follows:—From the northern ports, 13,082 tons; Yorkshire ports, 8,463; Liverpool, 19,022; Severn ports, 22,329; and Scotch ports, 952 tons. The total exports of coal from January to August, inclusive of the present year, amount to 4,935,705 tons, showing a decrease of 22,688 tons as compared with the shipments of the corresponding period of last year. Of the exports this year France has taken 858,584 tons; Germany, 441,307 tons; and the East Indies, 385,714 tons.

The anchorage for one set of chains for the Clifton Suspension Bridge is now complete, and the work of hanging the links will be at once commenced, thus exhibiting a perceptible progress. Great hopes are entertained that the bridge may be completed by June next, in which month the meeting of the Bath and West of England Agricultural Society will be held at Bristol, at which his Royal Highness the Prince of Wales, who has accepted the office of patron, is expected to be present. If, however, the work should not be finished by that time, there is little reason to doubt that it will be accomplished by September, 1864, in which month the British Association will assemble at Bath, and the completion of the bridge—the foundation of which was laid by the Marquis of Northampton, a former President of the Association, so far back as the year 1837, on the occasion of the visit of the Association to Bristol—might then be fitly inaugurated.

The second trial of the iron-plated screw steamship "Prince Consort," 35 guns, 4,045 tons, which took place at Plymouth, on Thursday, was considered satisfactory. The mean speed attained in six runs was 13·132. The trial was at full boiler power. Both the engines and boilers worked exceedingly well, and although in some of the runs the wind freshened from an average of 3½ up to 5, it appeared to have very little effect on the speed of the vessel.

The Agricultural Society of Suffolk have adopted a resolution under which the association recommends the appointment of a competent engineer as inspector of agricultural engines. The inspection is proposed to be made at least half-yearly at a certain fixed payment per engine for each examination, the charge to be paid, with the exception of a small annual grant from the funds of the association, by the owners of the engines. The inspector will be required to keep a registry of all engines inspected by him from time to time, with the name of the makers, the date or age of the engine, and the limited amount of pressure in pounds to the square inch upon the boiler—all of which is to be painted in large and legible letters upon the engine. The inspector is also to examine every engine-driver as to his fitness, and, if satisfied with him, to give him a certificate which will enable him to wear a badge on his right arm, having a number upon it corresponding with the inspector's book. This badge or distinction the driver is to be obliged to wear when at work with his engine. The inspector is also once a year to make out a schedule of all engines examined by him, with a report upon their condition, together with any suggestion which may occur to him in the course of his inspection.

The division of iron-plated vessels collected at Cherbourg was to have put to sea on Sunday afternoon. It is to double the Isle of Ushant and steer towards the coasts of Spain. The first cruize is to last for from twelve days to a fortnight without anchoring. Vice-Admiral Penaud, president of the commission charged to watch the experiments, hoists his flag on board the "Solferino." The other members of the commission are distributed among the four frigates, which, with the "Solferino," form the division. There are the "Couronne," the "Magenta," the "Invincible," and the "Normandie." The steam advice-boat "Talisman" is placed at the disposal of the vice-admiral for the service of the division during the whole course of the experiments.

We have heard with regret of the death, after a protracted illness, of William Buckle, Esq., Assistant Coiner of the Royal Mint. That gentleman was widely known in the mechanical and engineering world; and the respect in which he was held was as extensive as was his acquaintanceship with members of those professions. Mr. Buckle was, for more than thirty years, manager of the Soho Works, for Messrs. Boulton and Watt; but during the past twelve years he had occupied the post above named. The death of the lamented gentleman took place at the Mint, on the 30th ult.

Shaver's patent eraser is an extremely ingenious little instrument, recently brought under our notice, containing a burnisher, paper-cutter, folder, and pencil in a neat and elegant form. It is decidedly the best thing of its kind.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 512.
Boilers and Furnaces—*none*.

491. R. Martindale. *Improvements in lamps and burners, and in apparatus employed for milling or ornamenting parts of lamps, which apparatus may also be applied to other similar uses.* Dated February 23, 1863.

This invention consists—1, of improvements in the construction of oil, hydro carbon, and other similar lamps, and burners used for other purposes than lamps, of the description in which a flat cotton can be employed to form a cylindrical wick by the following means:—The patentee alters the form of the wick case, which is usually a circular tube, and makes it either flat or semi-annular at its lower end, and merging into a circular tube or cylinder above. An inner tube around which the wick is arranged reaches slightly below the shoulder of the outer tube or wick case, that is to say, slightly below the point at which the flat or semi-annular portion meets the circular part. This inner tube serves as a guide to the cotton, and causes it to assume a tubular form; or, by the employment of a suitable guide or funnel, he can insert these flat wicks at the top of the wick case and wind them down the tube into their proper position. The winding these wicks he effects by employing a thumb button and series of toothed wheels and rollers which serve to maintain the vertical position of the cotton; or he can employ a cotton holder and cap worked up by means of a slide, or by a lever or a series of wheels, as above described for the purpose of raising the wick; or it may be done by means of a cap working up a slot or groove in the inside of the wick case. 2, The invention consists of improvements applicable to gas as well as other descriptions of burners. He surrounds the burner with one or more air chambers or cones, each separated from the other by its own windguard, by which arrangement more perfect combustion is insured, and a smokeless or nearly smokeless flame is obtained. 3, The invention consists of improvements in apparatus to be employed in milling or ornamenting parts of lamps, which apparatus may also be applied to other similar uses. In place of the chock of an ordinary lathe, he inserts a block piece or holder to receive the stamped or shell work to be milled. In front of this holder he fixes upon a jointed arm in a rest a lever rod, forked at one end to hold a revolving wheel or roller engraved with the pattern or mill; the shell or stamped work being fixed upon the holder, the operator by a motion of the lever rod brings the milling roller into contact with the shell, and thus the pattern or milling is produced upon the shell. If a pattern or mill be required upon the interior of the shell also, the holder in the lathe is engraved with a pattern. For solids, such as thumb buttons, screws, and other like articles, a very slight modification of the form of the holder, or the use of clams, will allow of their being similarly milled or ornamented. *Patent completed.*

492. T. R. Harding. *Improvements in carding and combing flax, wool, cotton, and other fibrous substances.* Dated February 23, 1863.

This invention relates to the application of drawing-off rollers or other similar apparatus to cylinders covered with teeth or other carding surface for the purpose of drawing-off and separating the longer and more valuable portion of the material under operation, both from that portion which is shorter in the fibre, and partakes more of the nature of noil, and also from all impurities and refuse. *Patent completed.*

493. T. and A. L. Dickens and H. Heywood. *Improvements in ornamenting plush and other such textile fabrics.* Dated February 21, 1863.

This invention relates to those fabrics which, after the manner of woollen or other plush, are provided with loose, floated, or raised fibres produced either during the process of weaving, or by a subsequent process, such as "raising." These fabrics the patentees dye by the usual operations, and then protect any desired portions thereof, so that they will resist a further application of dyeing or printing materials. The surface is then brushed over, or is otherwise treated with a colouring matter, whereby the face or raised fibres are tinted, leaving the back or groundwork with its original tint; the prohibited portions, however, not having been submitted to the secondly named dyeing process, afford the desired pattern. *Patent completed.*

494. J. Tatham. *Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.* Dated February 23, 1863.

This invention relates—1, to the drawing frame, and consists in a method of driving the coilers thereof. For this purpose the patentee places the line shaft above the carrier wheels which impart motion to the said coilers; and in order to enable him to adopt this arrangement, he forms the beam which supports the stands or slides so that the top thereof extends partly only between the front and back portions of the said beam. Another part of the invention relates to feed rollers of preparing machinery, and consists in so disposing them that the fibrous material is caused to lap around one or more of their surfaces. Another part of the invention relates to the slubbing frame, and consists in conducting the material after it leaves the delivering rollers, and before it reaches the floor, through a trumpet or guide, whereby the said sliver is brought into a cylindrical form. *Patent completed.*

495. J. Erwood. *Improvements in producing imitation gilding on paper-hangings and other surfaces, also in metal leaf and metallic or bronze powder suitable for the purpose.* Dated February 23, 1863.

In producing imitation gilding on paper-hangings and other surfaces it is now common to employ a metallic leaf known as Dutch metal, and a metal powder or finely divided leaf called bronze powder is also made use of; these both, however, lose their brightness in a short time. According to this invention, the inventor employs in place of these materials a metallic leaf prepared from gold coloured alloys of copper and aluminium (he uses about 10 parts of aluminium and 90 parts of copper) by rolling, annealing, and beating the said alloy, and he applies the said leaf to the paper or surface to receive the imitation gilding in the same manner as that in which Dutch metal is commonly applied. He also employs for the same purpose a metallic powder made from the same material, and this he applies in the same manner as that in which ordinary bronze powder is commonly applied. In producing the metallic leaf from the alloy of copper and aluminium, he employs the processes now adopted for making Dutch metal; and in producing the improved bronze powder from the alloy of copper and aluminium, he employs the processes of rolling, beating, stamping, and grinding, as is practised in making ordinary bronze powder. *Patent abandoned.*

496. H. Masters. *Improvements in spools, bobbins, rollers, and similar articles.* Dated February 24, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

497. D. Spink. *Improvements in the construction and arrangement of armour plates for ships.* Dated February 24, 1863.

In carrying this invention into effect, plates or bars of wrought iron, steel, or other material adapted for the purpose, are placed with their edges outwards, such plates or bars having projections formed thereon out of the plates or bars themselves, so as to constitute an armour of great strength. The plates or bars are connected tightly together by means of large bolts passing through the sides thereof, such bolts also serving by means of small eyebolts through which the former pass to secure the armour to the hull of the ship. *Patent abandoned.*

498. W. and H. Whitehead and H. Barber. *Improvements in the manufacture and securing of cutlery handles, and machinery employed therein.* Dated February 24, 1863.

This invention is not described apart from the drawings. *Patent completed.*

499. J. Clay. *Improvements in the manufacture of saddles.* Dated February 24, 1863.

In making the pads and rolls and the upper leather according to this invention, the patentee takes a pair of moulds having internally the figure which it is wished to give the upper leather, that is to say, having the figure of the saddle with its projections. He wets the leather and places it upon the lower or convex mould, the wetted leather being held and compressed between the two moulds. The leather is allowed to become dry in the moulds, and when dry it is removed from the said moulds, and the hollow portions having the figures of pads or rolls, are filled with stuffing. The said upper leather having the pads and rolls thus made in it is secured to the stout leather called the shield or under-flap and skirt in the usual manner. Where it is wished to ornament the saddle by embossed or raised ornaments, they may be made at the same time, and in the same manner, as the rolls and pads. The whole of the upper leather, that is to say, that covering the flaps, skirt, and seat of the saddle may be made together with the required pads, rolls, and ornaments from one piece of leather; or the pads may be made of two or more pieces, as in the ordinary way. *Patent completed.*.

500. J. Hawthorn. *Certain improvements in handles for doors, drawers, and other means of enclosure.* Dated February 24, 1863.

This invention relates to the manufacture of such handles or knobs for doors, drawers, &c., as are made of china, clay, earthenware, and other argillaceous substances, and is designed for the purpose of combining a screw therewith in such a manner that it may have a secure hold in the handle, the projecting part of such screw being the means of attaching the handle or knob to the door or drawer. The improvements consist in the employment and use of a metal male screw fitting into a female screw tapped on the handle or knob, and so secured therein; such combination forming a more perfect connection between the metal and earthenware than hitherto attained. The opposite end of the piece of metal is also screwed, by which means the handle is secured to the door or drawer. *Patent completed.*

501. G. Davies. *An improvement in melting and smelting furnaces.* (A communication.) Dated February 24, 1863.

This invention consists in applying to a foundry, cupola, or other furnace (substantially in the manner described) a box of any suitable form, having an opening through which may be discharged the slag or scoria which flows into the box from the furnace through another opening, and through which the molten metal—which also passes from the furnace into the box—may flow from the latter. The object of this invention is to obviate the difficulties which arise from an accumulation of undue quantities of slag or scoria in melting and smelting furnaces. *Patent completed.*

502. W. E. Gedge. *Improvements in the manufacture of hats.* (A communication.) Dated February 24, 1863.

The hat body, according to this invention, is made of silk stuff thoroughly steeped in an impervious preparation or stiffening composed of gum lac and gum elemi dissolved in about equal proportions of spirits of wine, and after the body has been stretched on a suitable frame, any impurity or shade left by the stiffening washed off, and the glossiness of the stuff restored, the tip and brim are then cut and placed on the form, a strip of gauze only being used as a band where the junction of the plush is to be made. Varnish or other coating is then placed on the hat body, and any suitable material (usually silk plush) is glued over all. *Patent abandoned.*

503. J. W. Burton. *Improvements in the bearings and leashes of axles and shafts.* Dated February 24, 1863.

In carrying out this invention, the bearing or part on or against which the axle or shaft works is composed of glass, or other similar hard and smooth material or composition, and the flanges or ends or outer parts are composed of brass, or other suitable metal or alloy, and there is inserted between the said bearing and the flanges or ends pieces of wood, papier mache, felt, india-rubner cloth, or other similar non-metallic and partially elastic substance or material. The several parts are united as required by means of counter-sunk bolts, or in any other convenient manner. *Patent completed.*

504. J. Le Butt. *Improvements in machinery for dressing grain.* Dated February 24, 1863.

In place of employing flat screens, the inventor constructs screens in such manner that every alternate wire of the screen may either be stationary whilst the other wires are moved to and fro, or may be moved in the opposite direction to them. By constructing screens in this manner, the spaces between the wires will not have to be kept clear by means of discs or other instruments. When the screen is composed of a set of moveable wires and a set of stationary wires, the frame which carries the moveable wires may be carried by rollers running on inclined rails, and the frame may have the to-and-fro motion imparted to it by a crank or otherwise. The inventor, however, prefers to carry the moveable frame by means of upright springs of wood, or other material; there being, by preference, two springs on each side of the frame. When both sets of wires have a to-and-fro motion imparted to them, one set being moved in one direction whilst the other set moves in a contrary direction, he prefers to carry the frames of each set of wires by springs, as just described, but they may be otherwise carried. *Patent abandoned.*

505. W. Hooper. *Improvements in insulating and protecting telegraphic and other wires and rods, and in machinery connected therewith.* Dated February 24, 1863.

When covering and protecting telegraphic and other wires and rods with india rubber or compounds of india rubber, the patentee obtains the tapes or narrow strips to be employed by cutting a continuous sheet of india rubber or compound of india rubber from a block of the material caused to rotate in front of a knife, and afterwards he divides this sheet into tapes or narrow strips by a series of cutting edges, the interval between which is the width of tape required. He applies these tapes to the wire or rod by lapping it around the same, as heretofore practised. India rubber and sulphur (or a substance having a similar action), combined, by preference, with tar or any of the articles usually employed with india rubber and sulphur, may be cut into tapes or narrow strips, and applied as above described, and he vulcanizes the same by the well-known methods of vulcanizing after the wires or rods are coated. He varnishes such sheets, tapes, or strips of india rubber or india-rubber compound to keep them from adhering together, and also to prevent them taking up dust or dirt that may come in contact with them, or absorbing moisture from the atmosphere. This varnish may be composed of half a pound of shellac, half a gallon of water, and two or three fluid ounces of strong liquid ammonia. When only one side of a sheet is varnished, a small quantity of colouring matter is mixed with the varnish to show on which side of the sheet or tape the varnish has been applied. Before coating the wires or rods with the tapes or strips, he submits the latter to a uniform temperature (he prefers about 60 deg. Fahrenheit), to cool them in the summer, or to warm them in the winter, as the case may be, by which means, when they are lapped on the wires or rods, or passed through discs to coat the same, they will work more accurately than heretofore when the tapes or strips have been applied without regard to temperature, which has given rise to unequal suppleness, and, as a consequence, eccentricity of the conductor. *Patent completed.*

506. D. B. Chatterton. *Improved brick-making machine.* Dated February 24, 1863.

In carrying out this invention, the inventor employs a shaft which, upon power being applied thereto, gives motion to a pinion, to a bevel pinion which acts on a spur wheel, to another bevel wheel, thereby giving motion to another shaft with other bevel wheels, and to a screw placed in a hopper or feeding tube, by which the clay placed therein will be forced into moulds arranged in a circular, or approximately circular, frame. The spur wheel aforesaid will likewise give motion to a crank or eccentric, and, by endless band or cord, to a pulley working the delivery band or apron hereafter described. The crank acts on a lever carrying at its end a stamp mould. The eccentric has a rod attached, terminating in a pall working on the face of a pall wheel, which gives motion to the circular mould frame aforesaid. The hopper being filled with clay, and the machine being put in motion, the screw is caused to force the clay into the moulds, the pall acting on the pall wheel moving the moulds partly round, and bringing a mould under the press or stamp, the stamp being forced into this mould and moulding the brick; on its being withdrawn by the backward action of the crank, the pall moves the mould frame another part of a circle, the clay in the meanwhile having been forced into the next mould, the lever pressing the brick as before. The circular frame being forced round, brings the loose

bottom of the moulds to bear on the top of the eccentric keyed fast on the fixed shaft, and forces the loose bottom a portion of the way out, and the moulded brick with it, and so on until the brick falls on the endless band or apron prepared for that purpose, worked by the pulley which moves the brick, until it is taken from the band. After the brick is forced out of the mould, the eccentric acts on a roller and forces the loose bottom back to its place, so that the mould can again be filled at the feeding tube or hopper. *Patent abandoned.*

507. E. R. Walker. *Improvements in valves, and in apparatus connected therewith.* Dated February 24, 1863.

The patentee claims—1, the method of reducing the friction on the surface of the slide valves by means of a flexible plate or plates of whatever form attached to the valve, and against which the steam or fluid presses, so arranged that this pressure against the plate neutralizes or tends to neutralize the pressure against the valve, as before described; 2, the method of reducing the friction on the surface of slide valves, by means of a plate or plates covering an open-backed valve, and attached to the flexible plate, as before described. *Patent completed.*

508. H. B. Willson. *Improvements in the construction of war and merchant ships.* Dated February 24, 1863.

The main object of this invention is so to construct war and merchant vessels that, although built of large capacity, they shall be able to navigate shallow waters and obtain high speed with moderate power. The following are some of the important features of the invention. The inventor forms the hull of the vessel in midship cross section of a figure approaching that of a parallelogram, the lower immersed angles being rounded off to mitigate resistance, and the more ready to reflect wave undulations, and for the same reason he also curves the bottom or floor downwards from a few feet on each side of the keel, which thus becomes enclosed inside the ship's skin from end to end. The rest of the floor is made long and level to give buoyancy and prevent the ship from pitching deeply into the seas. This enables him to give a finer entrance and run, which he prefers to be slightly hollowed to lessen resistance. The longitudinal as well as the general strength of the ship he secures by carrying a central wall constructed in the same manner as the side walls from the keel, to which it is fastened at all points up to the main deck, so far fore and aft as may be necessary to obtain adequate strength; and in cases where the necessary stiffness cannot be thus gained, he springs an arch nearly from one end of the vessel to the other, so as to make it constitute a part of the structure of the central wall, which arch may be carried above the upper deck in merchant vessels to such height as may seem needful. This central wall also adds security to the ship by dividing it into two longitudinal and equal water-tight compartments. The transverse girders extend from either side the vessel's framing, to the central wall or great longitudinal girders, and are firmly secured thereto, by which means the central wall or girder remains unbroken and unimpaired in strength. *Patent completed.*

509. G. A. Huddart. *Improved means of imparting heat to fluids.* Dated February 24, 1863.

The chief object of this invention is to facilitate the raising of steam in steam boilers. This the inventor proposes to effect by partially filling the water space with a good heat-conducting material, such as solid or hollow pieces of iron of various shapes, which when thrown into a steam boiler, will so arrange themselves as to form a kind of porous filling that will not interfere with the circulation of the water, but will occupy a considerable portion of the water space. *Patent abandoned.*

510. A. Junger. *An improved life-preserving garment.* Dated February 24, 1863.

This invention consists in constructing a garment in the shape of a cape coat, so cut and padded with ground cork or cork shavings, or other like suitable buoyant materials, that, on a person wearing it entering or falling into sea-water, he shall be supported in a vertical position with his body from the waist upwards out of the water. In other than sea water the body would sink some few inches deeper. *Patent completed.*

511. T. Mallinson and J. Livingston. *Improvements in throstle spinning and doubling frames, wholly or partly applicable to roving and slubbing frames.* Dated February 24, 1863.

This invention refers to machines for spinning and doubling of the character of the throstle frame, and also wholly or partly applicable to roving and slubbing frames, and its main object is an improved arrangement and construction of parts with a view to a more perfect lubrication of the bearings of the spindles of such machines. The invention consists in constructing the footsteps for the spindles by a part which resembles a thimble in form, or a tube closed at one end, which is made, by preference, of cast iron, and in the hollow of this thimble part a piece of brass is inserted, so that a cavity is left between two sides and the bottom of the brass and the interior sides and bottom of the thimble part. The brass has a hole drilled through it for the foot of the spindle to pass through, which rests on the bottom of the thimble part, which is secured in the spindle rail by a set screw, the same as the ordinary footstep. With this arrangement, the lubricating matter is filled into the cavity formed between the brass and interior of the thimble part, and by the rotation of the spindle a constant circulation of the lubricating matter is maintained, as the oil passes from the bottom of the cavity up the centre, and descends to the bottom of the cavity down the sides. The invention further consists in making the moveable spindle rails with a cavity in the upper side of the rail to give space around and above the collar (which is screwed into the rail) for lubricating matter and a washer or strip of fibrous material, the "washer" or "strip" being provided with holes, so as to pass on to the spindle. *Patent abandoned.*

512. R. W. Thompson. *Improvements in obtaining and applying motive power, which improvements or parts thereof are applicable for raising, forcing, and measuring fluids.* Dated February 24, 1863.

This invention relates in the main to the arrangement and construction of an improved rotary steam-engine, which consists of a cylinder or steam chamber with a horizontal axis containing within it two diaphragms or pistons. One of these pistons or diaphrams is keyed upon a solid shaft passing through the axial line of the cylinder, whilst the other is similarly keyed upon or attached to a tubular or hollow shaft, through which the solid shaft is passed. The hollow or tubular shaft passes out of one end of the steam cylinder by a shifting box in the ordinary manner, and the solid shaft passes through it. Each shaft has keyed upon it a working crank, and these two cranks have connecting rods, the opposite ends of which are jointed to the rim of a fly-wheel, disposed eccentrically as regards the steam cylinder by means of suitable joint studs. The positions of the pistons accord with those of the external cranks, and the actuating steam is admitted to one side of the pistons or diaphragms and discharged on the other by valves of any suitable form. At the "dead point" of the engine the two pistons or diaphragms themselves close the steam cylinder ports. If, now, the fly-wheel moves round, one piston will pass the induction port, and the other will pass the eduction port, both moving in the same direction. But when steam enters by the induction port, it tends to cause the two pistons to move in opposite directions. But as the two pistons are set to revolve upon one main centre, and are connected by the cranks and connecting-rods with the fly-wheel, as hereinbefore referred to, working upon a separate and independent centre, it follows that the front or first piston will increase in velocity, whilst the opposite or second piston decreases in speed, the steam being introduced between the two. The result is that, during a complete revolution of the fly-wheel, each of the pistons will traverse three-quarters of a revolution with the actuating steam pressure, and one-quarter of a revolution against it, giving together a working traverse equal to one and a half revolutions. During this amount of traverse each of the pistons is working through a quarter of a revolution against the pressure of the steam, and this, being deducted from the amount of forward motion, leaves a complete revolution of the piston corresponding to that of the fly-wheel with the pressure of the steam available as power. *Patent completed.*

513. G. Bower and W. Hollinshead. *Improvements in apparatus for the production and transmission of gas or other fluids.* Dated February 24, 1863.

This invention consists in constructing dry centre valves used for the transmission of fluid, gaseous, and liquid bodies through a series of four or more separate vessels, in such a manner as to enable the gas or liquid to be conducted through any one, two, three, four, or more of such vessels, but more particularly the application of such valves to the changing of a current of gas in any direction, so as to cause it to pass through any desired number of a series of four or more purifiers. Also in combining with one or more of the various parts of apparatus required for the cooling, cleansing, and purifying of gas, embracing such as are technically called the hydraulic main, scrubber, washer, and purifiers, with a dry centre valve, or a dry centre valve and by-pass valve or valves, so that the combination, in whatever form it may exist, shall enable as desired one, two, three, or more purifiers to be in operation at one time, with power also to pass or shut off the gas from any part which may require the gas to be excluded from it, the whole being within the limits of a single base. *Patent completed.*

514. W. Clark. *Improvements in sewing machines.* (A communication.) Dated February 25, 1863.

This invention consists in certain novel devices for extending the loops of the upper or needle thread on the under side of back of the cloth, or other material to be sewed, and carrying the under or locking thread through them; also in a novel mode of combining the needle-operating lever with the said devices for extending the loops of the needle-thread, and carrying the locking-thread through them, whereby the operation of the said device is produced by the same crank or its equivalent by which the movement of the needle-operating lever is produced; also in a novel construction and arrangement of the feeding apparatus for feeding the cloth or other materials in all directions, and in a novel mode of applying the needle in combination with such feeding apparatus to keep the planes of revolution of the feed-wheel always at the same distance from the line of motion of the needle; also in an improved take-up for drawing back through the cloth or other material the slack of the loops of the needle-thread; and, further, in an improvement in the tension device for producing and regulating the tension on the upper or needle-thread. The invention cannot be described without reference to the drawings. *Patent completed.*

515. W. H. Lapthorn. *Improvements in reefing and furling ships' square sails.* Dated February 24, 1863.

These improvements in reefing square sails consist mainly in the application of cords or ropes to the upper part of the sail, which descend from the yard, and are rove through thimble loops worked on to the reef bands. *Patent abandoned.*

516. H. Wilde. *Improvements in electro-magnetic machines.* Dated February 25, 1863.

This invention consists in improvements in the transmitting instruments described in the specification of letters patent granted to the present patentee on the 8th day of April, and on the 10th day of August, 1861, and numbered 858 and 1994 respectively. In the specification of these patents transmitting instruments are shown and described in which the armature of a magneto-electric machine is mechanically geared with a radial arm, which travels beneath a series of finger-keys, any one of which being depressed, arrests the motion of the radial arm, and also the motion of the armature with which it is mechanically connected. In the present improvement the alternately inverted currents (or currents passing in opposite directions) generated during the continuous revolution of the armature of a magneto-electric machine are made to pass in one and the same direction by means of a commutator or current-changer of the ordinary construction placed on the armature or other axis connected with the ends of the wires in which the currents are generated. These direct currents are then transferred by means of wires to another commutator, by which the currents are again inverted previous to their passing into the telegraphic circuit. This last-mentioned commutator is made to revolve more slowly than the other, so as to allow a greater number of the direct currents from the first-mentioned commutator to pass into the telegraphic circuit before the currents are again inverted. From the relation which the more slowly moving commutator bears to the more quickly moving commutator of the magneto-electric machine, the patentee calls it a differential commutator. This differential commutator is fixed on the axis which carries the radial arm and index finger of the transmitting instrument, or other axis geared with it, and is so constructed as to invert the direct current from the other commutator as many times as there are letters or signs on the dial of the indicating instrument. *Patent completed.*

517. F. A. Gatty. *Improvements in printing and dyeing cotton and other fabrics.* Dated February 25, 1863.

This invention consists in producing a black colour, either in combination with other colours or alone, on cotton and other fabrics, in the following manner:—When the fabrics are intended to be prepared with mordant for dyeing, the patentee takes acetate of alumina (commonly called red liquor) at 10 degs. of Twaddle's hydrometer, and dissolves in it eight ounces of bi-chromate of potash to every gallon of acetate of alumina. Any other soluble chromate will answer the purpose, but he prefers to use the bi-chromate of potash. He then pads or otherwise impregnates the cotton or other fabrics with the said mixture of acetate of alumina and bi-chromate of potash, and dries them. They are then printed with a thickened solution of a salt of aniline or other similar tar products. He finds the following proportions to answer best: One gallon of water is thickened with one pound of starch, or other suitable thickening substance, and when cold he adds one pound of aniline, previously mixed with one pound and a quarter of muriatic acid of commerce, and one pound of water. Although he prefers to use muriatic acid, various other acids will answer the same purpose. After the fabrics have been printed, they are treated in the same way as mordanted fabrics which are intended to be dyed with madder, garancine, or other colouring matters. *Patent completed.*

518. R. Maynard. *Improvements in portable chaff-cutting machines.* Dated February 25, 1863.

This invention has reference to a previous patent dated 3rd March, 1856, and consists in connecting to portable chaff-engines an elevator to convey the chaff sufficiently high for it to fall into a bag or other vessel suitable for carrying it away, instead of, as heretofore, permitting it to remain on the floor to be gathered up by hand. For this purpose the patentee conducts the chaff by an incline, or by any other suitable means, to a revolving fan, which is driven at a sufficient velocity to cause the chaff to ascend to the height required. Or to affect the same purpose, he employs an endless chain or band, to which is attached buckets or other projecting parts, and the same being passed over a revolving drum carries the chaff with it. Or he uses any other kind of elevator which, in practice, he may find suitable. *Patent completed.*

519. R. A. Brooman. *Improvements in lamps for burning petroleum and other similar oils, and in feeders or cans for supplying such oil to lamps.* (A communication.) Dated February 25, 1863.

This invention is carried out as follows:—The inventor covers the glass or other reservoir with a cap having a circular hole in the centre, to the sides of which aperture a ring with screw threads is fixed. This cap is dished round a portion of its surface, and apertures for the passage of the liquid are made through the bottom of the dish. A crown is fixed on this cap in such a manner as to be capable of being turned; it is solid with the exception of a slot or hole made in it. When the slot or hole is brought over the dished portion of the cap, passage for the liquid to supply the reservoir is opened. When the crown is turned so far round as to bring the aperture in the crown over the solid part of the cap, communication with the interior is shut off, and loss by evaporation through the supply aperture prevented. The feeder or can is provided with a two-way cock, opening into a nozzle, and communicating with the interior of the can when it is held in a position for pouring out its contents, but when the can is in any other position, the nozzle falls, and communication through the cock is thereby shut off. The gallery and upper parts of the lamp are fixed in the ring before mentioned by a solid plug, from which the gallery springs, being screwed into it. The plug is pierced through the centre to receive a tubular wick-holder; a sheath is fixed outside this wick-holder, the edges of which are turned down at top over and upon the sheath, and thus the sheath and tube are held together. The tube is fixed to the under side of the plug by means of flanges carried out from the bottom of the tube, and slots are made in the wick-holder and sheath for the reception of two spiked wheels fixed on an axis on which a button is fixed, and extending beyond the gallery for turning the wick up and down. The capsule or cap through which the wick passes is formed in a piece with a tube and a ring, the former for carrying the lamp chimney, and the other the globe, both resting upon the upper part of the gallery; the sides of the gallery are open, and a plate of wire gauze or perforated metal for dividing the air before passing into the capsule is supported by a flange on the inside of the gallery. *Patent completed.*

520. J. Fitter. *An improvement or improvements in the construction of castors for tables, chairs, and other furniture or other articles.* Dated February 25, 1863.

This invention consists in the arrangement of anti-friction rollers within an inclined circular groove formed round the under side of the castor socket, or round the under side

of the plate upon which the article to be moved is intended to rest. *Patent completed.*

521. W. READMAN. *Improvements in the manufacture of carbonate of magnesia, and of iodine and kelp salt, and other products from kelp.* Dated February 25, 1863.

By this invention the carbonate, whether in the ley or in the salts deposited from the ley during evaporation, is utilized in the manufacture of carbonate of magnesia from bittern, being the residual liquor derived from the manufacture of common salt, or from a solution of chloride of magnesium. The ley, or a solution of salts containing the carbonate derived from the kelp, is mixed with the solution of chloride of magnesium, the products from which are carbonate of magnesia and chloride of sodium. A portion of soda ash or other similar carbonate may be added. The resulting liquor and washings are evaporated in suitable vessels, and the soda and potash, as well as the iodine and bromine, are recovered in the ordinary manner. *Patent completed.*

522. E. B. WILSON. *An improvement or improvements in the manufacture of an alloy or alloys of titanium and iron.* Dated February 25, 1863.

We cannot give space to the details of this invention. *Patent abandoned.*

523. J. B. GREEN. *Improvements in the manufacture of paper.* Dated February 25, 1863.

Here the wire mould on which the pulp is spread is formed with certain portions of its surface in grooves or channels, so as to be capable of receiving a greater depth of pulp at such portions. By this means, an increased thickening or density of the paper is produced at those parts which correspond with the grooves or channels in the surface of the mould. *Patent abandoned.*

524. R. LAWRENCE and W. NIBLETT. *Improvements in apparatus for regulating the flow of gas for purposes of illumination.* Dated February 25, 1863.

This invention consists in placing over and upon the ordinary gas-burner a tube or cylinder of any suitable metal or other material, fitted at the top with an adjustable cap, piston, or plug. The slits or apertures for the escape of the gas are cut either in the cap, piston, or plug, or in the tube or cylinder. The objects of the invention are, in the first place, to admit the gas from the ordinary burner into a chamber for the purpose of allowing it to expand, thereby reducing its pressure; and, secondly, by the proper adjustment of the cap, piston, or plug, to allow the gas to escape through the slits or apertures at that pressure which is most desirable to produce complete combustion, and to develop the illuminating powers of the gas to the greatest possible extent. *Patent completed.*

525. J. GAILEY. *Improvements in apparatus for the purpose of supplying air for mixture with gases and other aeriform fluids.* Dated February 25, 1863.

This invention consists in the use of two chambers or receivers similar to gas holders, that is to say, they are chambers inverted and open at bottom, and dipping into outer casings containing water or other fluid, which inverted chambers have alternate up-and-down reciprocating motion imparted to them. The interior of such chambers, have air inlet and outlet communications—the inlet being controlled by suitable valves to permit the ingress, but to prevent the egress of the air; while the outlet passages are similarly furnished with valves to permit the egress of air, but to prevent the ingress. Those outlet passages communicate with a reservoir to contain the supply of air furnished, from whence it may be drawn for the purposes required. A safety or pressure valve may be applied to this reservoir to regulate or limit the pressure of air therein. The inventor communicates motion to the reciprocating chambers by means of a spring train, or it may be a weight, a slight pressure and a small quantity of air only being required for the purposes to which he applies the apparatus. In connection with the train of wheels, he uses what is known as the mangle motion, which, although the train always moves continuously in one direction, a reciprocating rotary motion is communicated to a wheel by reason of the pinion communicating the motion from the train gearing with a segment of teeth alternately on the inside and then on the outside of the periphery of such segment, as is well understood. To the wheel so actuated he attaches a rope or chain, from the ends of which the inverted chambers are suspended, and by which the reciprocating rotary motion of the mangle wheel imparts a slow up-and-down motion to the inverted chambers, and so forcing a supply of air. *Patent abandoned.*

526. J. EDWARDS. *Improvements in the manufacture of buttons.* Dated February 25, 1863.

This invention consists in fixing the colour of what are termed gilt buttons by an application of silver varnish, or any other suitable varnish or liquid. This varnish protects the gilding from the action of the atmosphere or sea air, and is applied the same way as lacquer. *Patent abandoned.*

527. H. H. HENSON. *Improvements in mats.* Dated February 25, 1863.

One part of this invention consists in first forming oval and other shaped strands of cocoa-nut fibre, or other similar fibrous materials, or mixture of such materials, by inserting into them a core of thin japanned or painted metal or wood, cane, or other suitable material, and then constructing mats of these strands, by preference, in such a manner that the strands being placed on edge, and some of them being made wider than others, such strands are raised above the general level of the mat, so as to produce an uneven surface, and thus render the mats more efficacious as scrapers for removing the dirt from the boots. Another part of the invention consists in providing the ordinary fibrous mats with a waterproof backing, treated with any suitable waterproof material or compound in any stage of the manufacture, or afterwards, to prevent the same from being so readily saturated with moisture as at present, and thereby preserving it from decay. Another part of the invention consists in constructing mats the wearing surfaces of which are formed into two or more subdivisions, one or more of which has or have a fibrous pile surface, whilst the other or others is or are formed of an open or cellular structure flush with the pile, composed either of fibrous strands, india rubber, or its compounds or equivalents, or metal, thus combining the properties of a brush and a scraper in one and the same mat. Another part of the invention consists in constructing mats of any description with a removeable centre piece, so that when a centre piece is worn out it may be removed and replaced by a new one. Another part of the invention has reference to the manufacture of cellular india-rubber mats generally. *Patent completed.*

528. T. V. LEE. *Improvements in machinery for digging, compressing, and moulding peat or turf, and for retorts and kilns for drying peat or turf, and making peat or turf charcoal through the agency of hydro-caloric or superheated steam, and for collecting the products of distillation whilst charring the peat or turf.* Dated February 25, 1863.

This invention has for its object the preparation of peat or turf for smelting ores, for generating steam in marine and locomotive boilers, and for domestic uses, in a more economical and expeditious manner than any heretofore practised, and comprises, among others, the following features:—For digging peat the patentee employs a machine consisting of a revolving shaft carrying one or more series of spades set at suitable angles. This shaft is mounted in bearings, and rotary motion is given to it by the united action of toothed-gearing, a pair of rocking levers, and eccentric. The levers are connected to a vertical shaft, and each series of spades is brought into action alternately, and as each series takes up and delivers to a hand-barrow or other receptacle its number of sods or spits, drums or wheels on which the machine is mounted, actuated by the ratchet-wheel and eccentric, move the machine backward, and give room for the next series of spades to repeat the operation. That portion of the invention for triturating, compressing, moulding, and perforating peat, and cutting it into blocks of square or other shape, consists of a hopper in which are placed two pairs of rollers horizontally; they are furnished with teeth similar to the well-known bone and rag mill, the first or upper part being set about 4 in. apart, and in its passage between them the fibre of the peat is partially broken, and on reaching the second pair the process of triturating is completed, and a great portion of the water is in this part of the process liberated from the peat and runs off through a slot or perforations in a horizontal cylinder, into which the peat now rendered homogeneous falls. This cylinder is fitted with a shaft on which are affixed knives, arms, or blades which carry the pulp to the exit end, where a propeller forces it through the moulds of any required form. In the moulds are placed iron rods of three-fourths of an inch in diameter for perforating the blocks, and as the mass exudes, a knife is brought into use, and cuts off the blocks the size required. The blocks thus formed are fit to be handled, the process having deprived the peat of one half its water. This portion of the invention is worked by toothed gearing. The blocks formed in the manner described are placed upon carriages and run into retorts or kilns for drying or charring, as may be desired, the kilns being furnished with rail or tramway to correspond with similar rail or tramway outside. *Patent completed.*

529. W. E. NEWTON. *Improvements in producing stereotype plates for printing surfaces.* (A communication.) Dated February 25, 1863.

This invention relates to a means of producing curved plates. To this end the matrix is made on a sheet of steel, or other elastic substance, the normal shape of which is curved. But in order either to cast the stereotype plate, or to form the printing surface, by electro-deposition, the curved plate must be made to assume a flat or straight form by being secured down in any convenient manner to a flat plate, table, or surface. The clay, wax, or other suitable plastic material to form the mould or matrix is then put in the plate, and the impression is taken therein. The elastic plate is then released, when it assumes the curved form, and of course the matrix takes a corresponding form. The matrix or mould is then put on a curved plate or bed, and dried, and the stereotype plate is then cast or formed by electro-deposition. *Patent completed.*

530. W. HUDSON and C. CATLOW. *Improvements in looms for weaving.* Dated February 25, 1863.

This invention refers, firstly, to the motion for making the shed, and to that arrangement thereof in which a revolving tappet is employed acting at its upper and lower sides upon rollers connected to the treadles. According to this invention, the inventors mount these rollers upon an arm through which the tappet shaft passes so as to act as a guide and support for it. This arm is connected at its lower end to a treadle, which is thus caused to vibrate in order to form the shed. As applied to the arrangement above mentioned for making the shed, they cause one treadle to give motion to another by jointing the two together. Another improvement upon the said motion consists in mounting one or both of the rollers acted upon by the tappets upon springs, so as to yield when required. Another part of the invention relates to the beating-up motion, and consists in forming the connecting rod and stay as one rigid part, the latter being jointed to the lathe sword. Another part of the invention relates to the motion for taking up the work or for letting off the warp. For this purpose they use a plain wheel and clip or friction surface, which is brought into action by a lever acting thereon within the diameter of the work or warp beam. *Patent abandoned.*

531. N. THOMPSON. *Improvements in machinery for sawing wood.* Dated February 25, 1863.

In carrying out this invention, when sawing irregular or varying bevels, the patentee employs in front of the saw (which is by preference a band saw) a rotating fence, consisting of a wheel or pulley capable of revolving on an axis level with the surface of the saw bench, and in a line with the saw. Out of this revolving fence a quadrant is cut, and this serves as a guide for the wood to be sawn. In cutting a bevel from a plank or other piece of rectangular section, a line is marked on the upper surface of the wood, where the saw is to cut, and the angle of the piece of timber being laid in the angle of the fence, the cut is commenced, and then by inclining the wood more or less (the revolving fence moving with it) the saw is made to follow the line previously marked. This being done ensures obtaining the requisite bevel supposing the line to have been properly marked, as the fence obliges the saw to cut it out of the wood along the lower angle of the piece. *Patent completed.*

532. J. INGLIS. *Improvements in machinery or apparatus for folding paper and other fabrics or materials.* Dated February 25, 1863.

This invention relates to a system or arrangement of machinery or apparatus to be used for folding sheets of paper and other fabrics or materials, such as newspapers, sheets of paper for book-binding, and for other uses, and is partially based upon an invention of a machine for folding, for which J. Black, of Edinburgh, obtained letters patent in November, 1850. The present improved machine is contained upon and within an open rectangular framework, adjoining which and attached thereto, or forming part thereof, is a feeding table or platform, opposite to which the attendant stands. As each sheet is placed upon this table or platform from the bank or source of supply, a pair of grippers or traversing holders, actuated by the gearing of the machine, come forward and seize the sheet by its two opposite edges. The grippers then return to convey the sheet down from the table to an inclined folding platform attached to or forming part of the main framing. This inclined platform is set at a considerable angle with the horizontal line, and it has along its centre a longitudinal slot for the passage through of the paper during the primary fold. Directly on this slot is a serrated or roughened folding knife or thin lever arm, caused to vibrate back and forward by the main gearing. As the sheet of paper comes over the slot and beneath the folding knife, the grippers relax their hold, and the folder comes down upon the released sheet, forcing it through the slot, and thus producing the primary fold. The folded sheet is then passed beneath the platform, and is then in readiness for being refolded by knives or folding arms arranged at right angles to each other in the framing beneath. Suitable guides or register marks are provided for the due set of the sheet for the gripper action. *Patent completed.*

533. A. MACIVOR. *Improvements veneering or overlaying woods according to two methods—1, by means of steam exhaustion or air pressure; 2, by the employment of electro-magnetism.* Dated February 25, 1863.

This invention consists in two methods of veneering or overlaying wood—1, by means of exhaustion or steam-pressure, or air exhaustion or air pressure; and, 2, by the employment of magnetism. The invention cannot be described without reference to the drawings. *Patent completed.*

535. H. EDMONDS. *Improvements in the ventilation of ships and vessels, and apparatus connected therewith.* Dated February 26, 1863.

This invention consists in the application and adaptation of a system of shafts and air-channels to those parts of a ship's interior where ventilation is necessary, such shafts and air-channels acting directly upon the parts to be ventilated. *Patent completed.*

536. W. H. BROWN. *Improvements in window frames and in glazing windows.* Dated February 26, 1863.

The object of this invention is to render windows—and especially the windows of railway carriages, cabs, and other vehicles—noiseless at all times, and, when closed, dust and water tight. For this purpose the inventor constructs the window frames as follows:—When the outside edge of the sash is intended to slide—as in the case of the stiles of an ordinary sash window—he forms a groove along the outside edge. These grooves fit upon and slide along a beading of vulcanized india rubber, or other suitable fabric, which beading is fixed into the corresponding inner face of the stile of the window frame. Where there is much friction between the groove and the beading, he sometimes lines the groove with pewter or other suitable metal. When the window shuts upon or against the frame as in the case of a common sash window, he forms a similar groove along the edge or the face of the rail or stile, which shuts upon or against a corresponding beading fixed along the frame, upon or against which the window shuts. *Patent abandoned.*

537. C. RITCHIE. *An improved machine for making spiral lighters or spills from wood or other substance, and which machine will make and colour them, when desired, at one process or operation.* Dated February 26, 1863.

This invention consists in the use of a flat wheel or disc mounted on an axle and made to revolve in a suitable framework by means of steam or other power. On one side of the said wheel are fixed several pairs of brackets, each pair being parallel to each other, and capable of receiving and holding between them a piece of thin wood, or other substance, to be operated on and made into spills. Radiating from the centre of the wheel are several screwed rods—viz., one for each piece of wood. The use of the screwed rods is to force or feed the wood outwards towards the periphery of the wheel, and into contact with a skerved cutter or plane, which is there fixed in an adjustable manner to the framework, and so that, while the wheel is moved round, the said cutter will cut a spiral shaving from each piece of wood. On each of the feeding screws is a small cone, and an adjustable stud or projection from the framework comes into contact with the periphery of each cone as the wheel is turned round, and by its friction on the said cone moves the feeding screw round a small space, according to the desired amount of feed. Each feed-screw acts on the wood or other substance to be operated on through the medium of a flat rod of iron, which is doubled into somewhat of the form of a pair of sugar tongs, but having the hands brought nearly into contact, and screwed internally to form a divided nut in which the screw rod acts. This nut is made to close on the rod by means of a small ring removeable by hand when it is required to replace the wood or other material on the machine. *Patent completed.*

538. G. H. LILLEY. *Improvements in apparatus for connecting and securing together planks of wood, applicable to the building and caulking of ships and other vessels.* Dated February 26, 1863.

This invention consists in connecting and securing together planks of wood in the following manner:—As applied to securing the planks of ships, the inventor forms along the top and bottom edges of the planks, lengthwise, holes or apertures, the said holes or apertures in one plank corresponding with those in the other, and into which he inserts right and left-handed screws, the screws at or about their centre having nuts thereon with apertures therein. The material for caulking is led from one screw to the other between the planks, and by inserting levers in the apertures in the nuts, the planks are drawn together, the caulking between the nuts taking into recesses formed in the planks for that purpose, and thus a perfectly water-tight and finish joint is obtained. The material prepared for caulking is vulcanized india rubber, but any other suitable material may be used. *Patent abandoned.*

539. W. A. WILSON and J. SMITH. *Improvements in furnace fire-grates.* Dated February 26, 1863.

This invention relates to a novel arrangement of the parts forming furnace fire-grates, and consists in the use or employment of stationary bars and travelling bars, placed alternately, to form the support for the fuel; such bars, when so arranged, may be distributed either lengthwise or across the furnace. *Patent completed.*

540. A. [illegible]LLO. *An improved method of, and apparatus for, gl[illegible] morocco leather.* Dated February 26, 1860.

We cannot here give space to the details of this invention. *Patent abandoned.*

541. A. P. PRICE. *Improvements in the production and manufacture of blue colours.* (A communication.) Dated February 26, 1833.

This invention consists in the employment of acetates, citrates, succinates, racemates, malates, valerinates, carbolates, benzoates, cinnamates, tartrates, and oxalates of potash, soda, and ammonia in conjunction with aniline and roseine and rose-aniline, in the production of blue colours. *Patent completed.*

542. J. YATES. *Improvements in the manufacture of armour plates or blocks for defensive purposes.* Dated February 26, 1863.

The patentee claims—1, the manufacture of armour plates, blocks, or bars, by hammering, stamping, and squeezing or rolling them in metal moulds or frames of the size and shape of the plate, block, or bar required, substantially as described; 2, the manufacture of armour plates, blocks, or bars, by casting a metal backing on to a wrought-iron face plate or block, as described; 3, the manufacture of armour plates, blocks, or bars by hammering, stamping, or squeezing a wrought-iron plate or block whilst in a welding state on to a cast metal block provided with projections or indentations on its surface, for the more perfectly holding of the wrought-iron plate thereto, as described. *Patent completed.*

543. P. SPENCE. *Improvements in the manufacture of potash, alum, and other salts of potash.* Dated February 26, 1863.

This invention consists in manufacturing potash, alum, and other salts of potsh from those substances which are known as shales of the coal measures. *Patent abandoned.*

544. W. CLARK. *Improvements in the manufacture of buttons, and in apparatus for the same.* (A communication.) Dated February 26, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

545. M. PUDDEFOOT. *Improvements in implements for tilling and cultivating land.* Dated February 26, 1863.

This invention consists in the use of a truncated cone-like piece forming the body of the implement; this is mounted on an axis, and in a suitable frame, so as to turn in a rolling direction while passing over the ground. The frame is furnished with handles to guide it like an ordinary plough, and a beam, shaft, or parts to apply the tractive force. On the cone-piece or body at the large end, the inventor fixes in radial positions what he terms curved coulters or tines, pointed and sharp on the one edge, and thick on the other edge or back; on the other end of the cone-piece he mounts in similar radial positions a series of what he terms shares, being spade-like instruments which are set at an angle to the axis, and so as in revolving to throw the soil on one side, that is, in the direction of the length of the cone axis, and so forms a furrow; one, two, or more rows (in a circular direction) may be applied towards the end of the cone-piece. The implement in rolling over the ground causes the tines or coulters to enter and stir and break up the soil, while at the same time the spades or shares form the furrows. The tine and spades act on different parts of the soil at the same time during one traverse of the implement, loosening and lightening the soil to be operated on in the subsequent traverse by the spades. *Patent abandoned.*

546. J. HUMBY. *Improvements in furnaces and apparatus for manufacturing oxide of zinc or zinc white.* (A communication.) Dated February 26, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

547. R. J. NODDER. *Improvements applicable to hats, caps, helmets, military head-dresses, and other like coverings for the head.* Dated February 26, 1863.

The patentee claims the application to hats and other coverings for the head of a zone or band having the upper portion formed with a warp of metallic wire, or any other material which is non-elastic in the direction of its length, and the lower edge and lower portion and weft thereof of silk, cotton, mohair, or other suitable textile material, in the manner described. *Patent completed.*

548. F. H. TWILLEY. *Improvements in book slides or holders.* Dated February 26, 1862.

This invention consists in certain improvements in the construction of slides or holders for books, whether single or double slides, whereby they may be extended in width in order to hold a considerable number of books, or be reduced so as to contain a few books only, dispensing entirely with all cross-pieces as have heretofore been used. *Patent abandoned.*

549. J. H. ALBINSON and H. H. COCKER. *Improvements in spinning, doubling, throwing, and reeling silk, and in the machinery employed therein.* Dated February 27, 1863.

This invention consists—1, in adapting the usual wrapping machine now employed for testing the size of silk to the English weights and measures reduced to the decimal system, and in applying thereto a balance with a graduated quadrant for indicating the weight and size of the skein produced. The second improvement consists in applying the usual cleaners to the winding frame, thereby performing the operations of cleaning and winding simultaneously. The third improvement consists in the application of the usual throstle doubling and throwing silk threads, either organzine or tram. In order to render the above machine suitable for silk, the patentees apply thereto additional drag-rollers or pulleys for increasing the friction on the thread. They also apply the doubling-frame for winding and spinning silk direct from the cocoons. The fourth improvement relates to reeling, and consists in winding the silk threads from the bobbins produced on the machines above referred to in skeins of 1,000 yards, or other suitable length; the size is ascertained by a balance with a graduated quadrant; these skeins are divided into portions of 100 yards. *Patent completed.*

550. W. STAUFEN. *A new or improved fibrous substitute for human and other hair, to be used for all the purposes for which human and other hair is now used, and also for the manufacture of textile fabrics.* Dated February 27, 1863.

The patentee claims—1, the sole use of the fibres of the leaves of the Elais Guincensis, and of the leaves of palms of the same family, as a substitute for human and other hair, in the manner and for the purposes described; 2, the sole use of the leaves of the Elais Guincensis and of the leaves of palms of the same family, for the manufacture therefrom of textile fabrics, in the manner and for the purposes described. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 11, 1863.

1449. W. Clark, 53, Chancery-lane, engineer. Improvements in obtaining and applying motive power, and in apparatus for the same. (A communication.)

Dated July 30, 1863.

1887. J. B. Howell, Sheffield, steel manufacturer. Improvements in ordnance, firearms, and projectiles.

Dated August 17, 1863.

2041. R. Baillie, Glasgow, engineer. Improvements in reefing or furling the sails of vessels, and in the apparatus to be employed therein.

Dated August 18, 1863.

2056. C. G. Wilson, Blackheath, civil engineer. Improvements in machinery for pressing cotton, and for crushing and pressing other substances, the said machinery being adaptable for locomotion on railways or on common roads.

Dated August 27, 1863.

2119. C. Richard, 10, Rue de la Fidelité, Paris, gentleman. A new or improved apparatus for lighting and cutting the ends of cigars.

Dated August 31, 1863.

2145. G. Attock, engineer, Stratford. Improvements in assistant bearing springs for locomotive engines, railway carriages, waggons, and trucks.

2148. G. Bebbington, Manchester, salesman, and J. R. Hampton, packer. Certain improvements in means to be employed for securing the ends of bands in packing "bale goods," and in machinery for manufacturing "rivets" to be employed for the purpose, and also in apparatus for forming apertures in the aforesaid bands or hoops.

Dated September 1, 1863.

2160. P. Joyot, jun., Paris, manufacturer. An improved fabric, and improvements in looms for manufacturing the same.

2161. J. H. Banks, Radnor-street, Hulme, Manchester, church furniture manufacturer. Improvements in the construction of benches or desks for schools, churches, and other similar purposes.

Dated September 2, 1863.

2167. R. Young, Glasgow, millwright and engineer. Improvements in separating and elevating apparatus for grain or granular matters.

2168. E. Collier, High-street, Leicester, milliner and crinoline manufacturer. Improvements in crinolines and crinoline fastenings.

2171. E. Alcan, King-street, merchant. A new method of, and apparatus for, feeding wool and other textile and filamentous substances into carding, combing, and other machines for treating such substances. (A communication.)

Dated September 3, 1863.

2173. C. Jackson, Birmingham, engineer and machinist. Improvements in bolts for fastening doors, windows, shutters, and for other like purposes.

2175. A. A. Beaumont, 2, Rue Sainte Appoline, Paris. A new or improved engine for raising liquids.

2181. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improved apparatus for cleaning and decorticating grain and seeds. (A communication.)

Dated September 5, 1863.

2187. W. Lorberg, 4, Wyld's-rents, Bermondsey, analytical chemist. Improvements in the manufacture of gas and other substances from tan and similar materials.

2189. S. Mellbourn, Wallington Paper Mill, Carshalton, Surrey, paper maker. Improvements in the preparation of materials for the manufacture of paper, and in the construction of machinery employed for such purposes.

2191. T. Moody, Wincauton, Somerset, gentleman, and E. T. Moody, Chelsea Villas, West Brompton, civil engineer. Improvements in the generation and production of motive power to be applied generally, and in its special application to the propulsion of vessels.

2192. J. Rowell, Aberdeen, manufacturer. Improvements in the manufacture and construction of fences, part of which are also applicable to the manufacture and construction of gate-posts, and to poles and posts used for telegraph and signal purposes, and for stretching telegraph wires.

2193. T. Smith, Wolverhampton, merchant. An improved waggon break.

2195. C. H. Adames, Birmingham, manufacturer. Improvements in the manufacture of lids or covers for certain articles of hollow ware.

Dated September 7, 1863.

2197. F. Mills, Heywood, machine maker, T. Booth, mechanic, and T. Clegg, foreman. Improvements in machinery for preparing and spinning cotton and other fibrous substances.

2199. N. Singleton, Manchester, commission agent. Certain improvements in machinery or apparatus for cutting hay, straw, or other similar agricultural produce. (A communication.)

2201. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improved apparatus for directing motion in right lines. (A communication.)

Dated September 8, 1863.

2203. L. Mond, Appleton-in-Widness, Lancashire, chemist. Improvements in obtaining sulphur and sulphurous acid from alkali waste.

2205. J. C. Lott, Clyro (near Hay), Radnor. Improved apparatus for turning over the leaves of music.

2208. T. H. Baker, Tunbridge, Kent, engineer, and G. Friend, engineer. Improvements in treating excrementitious and sewage matters, and in the means or apparatus employed therein.

2209. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in machines for working and preparing skins. (A communication.)

Dated September 9, 1863.

2213. W. H. Tucker, 6, Southampton-street, Strand, lock manufacturer. Improvements in the modes of propelling and steering vessels.

2217. W. Glydon, Birmingham, manufacturer. Improvements in apparatus and machinery for the manufacture of metallic tubes and hollow cylinders, part of which improvements may also be applied to the casting of other hollow bodies.

2219. W. E. Gedge, 11, Wellington-street, Strand. Improvements in paving roads or ways. (A communication.)

2221. J. Robinson, Batley, York, stone mason. Improvements in steam boiler and other furnaces.

2223. N. Thompson, 15, Abbey-gardens, St. John's Wood. Improvements in apparatus for stopping bottles, jars, and other vessels, which improvements are also applicable for stopping the muzzles of firearms.

2225. W. Hutchinson, Salford, engineer. Improvements in steam engines.

2227. J. Maggs, Bartlet-street, Bath, decorator. An improved construction of fountain pen.

Dated September 10, 1863.

2231. W. W. Greener, Birmingham, gun maker. Improvements in breech-loading firearms.

2232. H. and J. W. Wright, Freedom Mills, Morton, near Bingley, Yorkshire, paper manufacturers, and W. Clough, Keighley, engineer. Improvements in glazing and rolling press papers, pasteboard, and other paper requiring to be glazed or rolled, and in the means or apparatus employed therein.

2233. M. A. Muir, Glasgow, and J. McIlwham, machinists. Improvements in machinery or apparatus for winding yarns or thread.

2234. W. Clark, 53, Chancery-lane, engineer. Improvements in the purification and disinfection of hydro-carburets, and especially of oils produced by the distillation of coal schist and boghead. (A communication.)

2235. J. H. Whitehead, Royal George Mills, near Manchester, woollen manufacturer. Improvements in the manufacture of felted fabrics.

Dated September 11, 1863.

2236. J. Hartshorn, Nottingham, lace manufacturer, and W. Redgate, draughtsman. Improvements in the manufacture of lace, and in means or apparatus employed therein.

2237. W. Taylor, Lawton Iron Works, Shiffnal, Salop, ironmaster. Improvements in the manufacture of iron rods, and in machinery to be employed in the said manufacture.

2238. L. Desens, Paris, No. 18, Rue de l'Echiquier, gentleman. An improved bath or bathing machine adapted for deep water.

2239. T. J. Sloan, Paris, engineer. Certain improvements in braiding machines.

2240. J. Rhodes, Morley, near Leeds, machine maker. An improvement in piecing machines.

2242. J. Dobbie, St. Petersburgh, civil engineer. Improvements in the construction of railway and other carriages.

2243. J. D. Lee and J. Crabtree, Shipley, near Bradford, York, machine makers. Improvements in looms for weaving.

2244. H. Chrichley, Birmingham, manufacturer. Improvements in stove grates and kitchen ranges.

2245. M. Gerstenhofer, Freiberg, Saxony. An improved construction of furnace for roasting pyrites.

Dated September 12, 1863.

2246. J. Crellin, Lime-street, Liverpool, plumber and brass founder. Improvements in appara[illegible] [illegible]erning and stopping the flow or passage of liq[illegible]

2247. J. King, Glasgow, chemist. Improved means for assisting and regulating the process of fermentation.

2248. O. E. Wallis, Millman-street, Bedford-row, Holborn. Improvements in revolving firearms.

2249. E. N. Gregory, Camberwell, wire cloth manufacturer. An improved method of uniting belts and lengths of wire gauze and other metal cloth.

2250. W. Clark, 53, Chancery-lane, engineer. Improvements in revolving firearms. (A communication.)

2251. D. S. Sutherland, 34, Great George-street, Westminster, civil engineer. Improvements in blasting rocks and other materials.

2252. J. A. Whipple, Boston, United States. Improvements in apparatus for supporting photograph cameras.

Dated September 14, 1863.

2254. W. R. Hutton, Glasgow, manufacturing chemist. An improved lubricating compound.

2255. T. Bell, Wishaw, manager. Improvements in apparatus for distilling shale or other bituminous minerals.

2257. G. F. Millin, Oxford. Improved arrangements for facilitating the quick detachment of horses or draught animals from carriages or vehicles, and for the application of break-power with the view to prevent accidents.

2258. G. W. Billings, New York. An improved method of preparing the fibres of hemp, flax, and other vegetable materials, for manufacturing purposes.

2259. W. Gassage, Widnes, Lancashire, chemist. Improvements in drying or curing certain vegetable productions.

Dated September 15, 1863.

2260. C. Battock, Wandsworth, fusee and match maker. Improvements in cigar lighters and fusee matches, part of said improvements being applicable also to vestas and matches, wax tapers, and candles.

2261. G. Howell, Old Kent-road, stationer. Improvements in machinery for stamping or obliterating and printing, especially applicable to post-office purposes, parts of which improvements are applicable to machines in which cams are employed.

2262. W. Thompson, 5, Rue Neuve des Martyres, Paris. Improvements in electric telegraph apparatus.

2263. A. Barclay, Kilmarnock, engineer. Improvements in locomotives or other steam engines.

Dated September 16, 1863.

2267. J. Cox, George Mills, glue maker. An improvement in swings.

2268. J. Rahill, Minories, mariner. Improvements in liquid compasses.

2269. A. Watson, King-street, City, engineer. An improvement in hinges.

2270. J. Daunatt, Sunderland, plumber. Improvements in the construction of apparatus for cooling liquids.

2271. B. Latchford, Upper St. Martin's-lane, bit and spur maker. An improved spur.

2272. B. J. Webber, Newton Abbot, Devon. Improvements in threshing machines.

2273. R. Thompson, Manchester, silk manufacturer. An improved mixed fabric, and in the application thereof to covering umbrellas and parasols.

2274. E. Scott, Manchester, engineer, and J. Starkey, Salford, overlooker. Certain improvements in looms for weaving.

2275. R. Harrington, Birmingham, umbrella furniture manufacturer. Improvements in umbrellas and parasols, and in parts thereof.

2276. J. M. Tate, Bermondsey Wall, Bermondsey. An improved method of hanging the lower topsail yards of ships and other sailing vessels.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, September 29, 1863.

1220. B. Shillito and D. Moor. Generating heat and motive power.

1227. J. Papin, C. Lintz, and L. Lavacherie. Manufacture of boots and shoes.

1228. R., W., and T. Waddington. Combs for combing wool by machinery.

1229. B. Browne. Manufacture of elastic material. (A communication.)

1232. F. M. Burns. Preventing the fouling of the bottom and sides of ships and vessels.

1236. W. White. Manufacture of looped fabrics.

1237. T. C. Stretton. Dressing lace or other fabrics.

1240. E. Christmas. Carriages for common roads.

1243. A. Heather and J. Redfern. Steam-boilers.

1249. S. Rhodes. Twisting and doubling cotton, hemp, flax, and other like fibrous materials.

1261. H. Wren and J. Hopkinson. Lubricating bearings.

1271. J. Steart. Extracting the fibre from zostera marina and other aquatic vegetable productions.

1278. E. Sonstadt. Manufacture and purification of the metal magnesium.

1280. J. Goodman. Velocipedes.

1282. W. Snell. Butt hinges. (A communication.)

1284. T. A. Blakely. Ordnance.

1286. T. A. Blakely. Rifling guns and forming projectiles to correspond therewith.

1290. J. Higgins and T. C. Whitworth. Roving, spinning, and doubling cotton and other fibrous materials.

1292. J. Sturgeon. Steam hammers.

1295. W. Cormack. Distillation of coal tar, tar oil, resin, resin oils, all hydro-carbons, petroleum, or other mineral or vegetable oils and spirits derived therefrom.

1296. S. E. Rosser and J. G. Jennings. Chimneys, fire-places, stoves, and flues for warming and ventilating apartments.

1297. J. S. Bickford and G. Smith. Firing explosive compounds.

1303. R. A. Brooman. Safety garments. (A communication.)

1305. G. Smith. Burning hydro-carbon oils. (A communication.)

1306. J. Hesford. Machinery and apparatus for stretching and drying fibrous materials.

1307. W. Muir. Machinery for cutting sugar.

1315. J. Hilliar. Construction of frames, sashes, shutters, blinds, and ventilators for windows or other openings.

1318. M. J. Roberts. Preparing, spinning, twisting, and doubling wool, cotton, and other fibrous substances.

1320. W. Clark. Ruling paper and other materials. (A communication.)

1326. F. W. K. and J. Kitson. Tyres for railway wheels.

1328. A. P. Hernandez and P. B. Crespy. Manufacture of soap.

1338. G. Gore. Gas-burners and gas-furnaces.

1340. H. Cartwright. Steering vessels.

1341. C. F. Baxter. Elastic stopper.

1349. A. Abadie. Railway breaks.

1352. G. H. Pierce. Heating buildings.

1379. E. J. Jarry. Machinery to be worked by steam or other power for clearing and ploughing land.

1384. J. Travis. Preventing the incrustation of earthy matter in steam boilers.

1405. W. Clark. Distillation and separation of hydro-carburets and their derivatives. (A communication.)

1502. F. S. Williams. Shaping plastic materials. (A communication.)

1503. W. Manwaring. Harvesting machines.

2056. C. G. Wilson. Pressing cotton.

2116. F. Pragst. Steam engines.

2148. G. Bebbington and J. R. Hampson. Securing the ends of bands in packing "bale goods," and in machinery for manufacturing "rivets."

2217. W. Glydon. Manufacture of metallic tubes and hollow cylinders.

2223. N. Thompson. Stopping bottles, jars, and other vessels.

2239. T. J. Sloan. Braiding machines.

2273. R. Thomson. A mixed fabric and the application thereof to covering umbrellas and parasols.

2320. W. Elsdon. Rail and road carriages.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated September 21, 1863.

2320. W. Elsdon, Sandridge, Bourke, Victoria, engineer. The construction of rail and road carriages and improved wheel tyres, and an improvement in railway crossings, adapting them to such carriages.

LIST OF SEALED PATENTS.

Sealed September 25, 1863.

326. H. Dircks and J. H. Pepper.
803. R. A. Brooman.
813. W. Symons.
815. J. Dale and G. Bischoff.
819. H. Hughes.
820. J. Carver.
824. E. T. Hughes.
825. J. Smethurst.
826. A. B. D. Maurand.
830. R. A. Brooman.
835. J. Hindle, W. F. Calvert, and E. Thornton.
836. I. Rowland.
837. J. Bray.
840. W. West.
841. W. Mitchell.
845. W. H. Phillips.
846. J. W. Law and J. Inglis.
847. E. F. Clarke.
849. J. Cassell.
850. J. J. Potel.
853. A. P. Price.
854. A. B. Seithen.
856. J. Blain.
857. P. Hanrez.
897. A. Hett and F. W. Basset.
924. J. Ramsbottom.
936. W. and J. Keats.
937. J. Combe and J. H. Smallpage.
938. J. Keats and W. S. Clark.
957. C. Terrett.
970. C. Turner.
971. B. J. Webber.
1006. G. B. Barber.
1067. J. H. Johnson.
1118. E. Chesshire.
1168. E. R. Clark.
1310. P. Leprovost.
1324. M. Henry.
1397. W. E. Newton.
1599. D. Hussey.
1670. J. Oxley.
1710. P. G. B. Westmacott.
1712. P. G. B. Westmacott.
1761. R. Hornsby, jun., and E. Phillips.
1800. G. F. Wilson and G. Payne.
1878. N. Thompson.
1881. W. E. Newton.
1890. R. Hoe & H. J. Cole.
1900. R. Stewart.
2009. S. R. Wilmot.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2316. J. H. Tuck.
2322. J. H. Johnson.
2325. G. Kind.
2335. W. Hargreaves.
2338. F. W. Daehne.
2340. J. McCrossan.
2348. M. Jacoby and J. Stones.
2351. W. A. Martin and J. Purdie.
2352. A. F. Sheppard.
2357. J. A. Callander.
2363. A. Warner.
2364. T. Robinson.
2386. J. L. Norton.
2461. T. Barnett.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2349. W. Marriott and D. Sugden.
2265. D. Law and J. Inglis.
2267. F. Ransome.
2293. J. Dauglish.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending September 26, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
352	1 10	372	0 4	384	0 4	396	0 10	408	1 0	420	0 [illegible]
357	1 10	373	0 4	385	0 4	397	0 4	409	0 4	421	0 4
361	0 10	374	0 10	386	0 8	398	0 4	410	0 8	422	0 4
362	0 10	375	0 4	387	0 4	399	0 4	411	0 10	423	0 [illegible]
363	0 8	376	0 8	388	0 8	400	0 6	412	0 4	424	1 4
364	0 4	377	0 4	389	1 2	401	0 10	413	0 10	425	0 4
365	0 4	378	0 8	390	1 4	402	0 10	414	0 4	426	0 10
366	0 10	379	0 4	391	0 10	403	0 10	415	0 8	427	0 4
367	2 6	380	0 4	392	1 0	404	0 4	416	0 8	428	0 4
368	0 6	381	0 4	393	0 8	405	0 4	417	1 6	429	0 4
369	0 10	382	0 8	394	0 10	406	0 4	418	0 4	430	0 [illegible]
370	0 8	383	0 4	395	0 4	407	0 4	419	0 4	431	0 4
371	0 4										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	
IRON:—					
Welsh Bars, in London	per ton	7 10 0	to	0 0 0	p ct 2½
Nail Rods	do	8 0 0		8 10 0	
Hoops	do	9 0 0		9 15 0	
Sheets, single	do	10 0 0		10 10 0	
Staffordshire Bars	do	8 10 0		8 15 0	
Bars, in Wales	do	6 10 0		6 15 0	
Rails	do	6 15 0		0 0 0	ne
Foundry Pigs, at Glasg, No 1	do	2 19 0		3 6 0	
Swedish Bars	do	11 10 0		12 10 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		16 10 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	103 0 0		0 0 0	3
Hammered Bottoms	do	112 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	107 0 0		0 0 0	
Tough Cake and Ingot	do	95 0 0		0 0 0	
Tile Copper	do	98 0 0		0 0 0	
Best Selected	do	98 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½		0 0 8¾	
Fine Foreign	per ton	98 0 0		100 0 0	
TIN:—					
English Block	per cwt.	6 15 0		0 0 0	2½
do Bar	do	6 16 0		0 0 0	
do Refined	do	6 0 0		0 0 0	
Banca	do	6 3 0		0 0 0	nett
Straits	do	5 18 0		5 18 6	
TIN PLATES:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 0	
Second Quality	do	1 7 0		1 7 6	
Coke	do	1 3 0		1 4 0	

TIMBER, duty 1s. per load, drawback 1s.

	£ s.	£ s.		£ s.	£ s.
Teak, load	£12 0	£13 0	Archangel, yellow	£13 0	13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
„ yellow pine	3 10	4 10	Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0	Memel	10 0	15 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
„ birch	3 10	4 10	„ white	9 0	9 10
„ elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderham	9 10	10 10
„ fir	2 10	3 10	Christiania, per C., 12 ft. by 3 by 9 in.		
Memel fir	3 5	3 10			
Riga	3 0	3 5	Christiania, yellow	21 0	23 0
Swedish	2 10	2 15	Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 1
Masts, Quebec red pine	5 0	6 0			
„ yellow pine	5 0	6 0	PUMICE STONE per ton	6 10	9 0
Lathwood, Dantzic, fm	5 10	6 10	OILS, &c.		
„ St. Petersburg	8 0	8 10	Seal, pale ... per tun	45 0	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Sperm body	80 0	0 0
			Cod	55 0	56 0
			Whale, Sth Sea, pale	42 10	43 0
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	60 0	0 0
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	47 0	0 0
Yellow pine, per reduced C.			Palm, fine	37 0	0 0
			Linseed	43 0	0 0
Canada, 1st qual.	17 0	18 0	Rapeseed, Eng. pale	44 0	0 0
„ 2nd do.	11 0	12 0	Cottonseed	38 10	39 0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number.— PAGE

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 9, 1863.

TWIN-SCREW STEAMERS.

FROM time to time reports have appeared in our pages of the performance of a few vessels built on the twin-screw principle by Messrs. Dudgeon, of Blackwall. The results obtained have been so satisfactory, that the subject is rendered worthy of deep consideration. To whom we are indebted for the first idea of this principle, it is not easy to determine. Captain Carpenter, of the Royal Navy, was perhaps the first to reduce it to a practical shape. This gentleman obtained a patent for his invention; but as he employed but one engine, he was unable to avail himself of the most important feature of the whole principle—that of using each screw separately, in order to turn the vessel. Mr. Richard Roberts, many years ago, proposed to overcome this difficulty by the use of independent engines; and it is to their use that the success of the "Flora," "Kate," "Ceres," &c., is mainly due. By running one screw ahead and the other astern, these ships are turned with ease on their centres as on a pivot, without changing their places more than a few feet in still water; the rudder having little or nothing to say to this action, as the ship has no way.

The application of two screws to the propulsion of sea-going ships has met with a vast deal of opposition; many persons considering it impossible that vessels so fitted could prove good sea-boats. This idea still obtains, to some extent; all sorts of objections being used against the use of double keels, &c. We must recollect, however, that not on this side of the Atlantic alone is the principle adopted with success; the Americans possessing many vessels both in the navy and mercantile marine so fitted, which have given the greatest satisfaction. Facts, such as these, are worth much more than theoretical reasoning, grounded on assumptions, the fallacy of which is demonstrated by actual practice.

In another of our pages will be found the report of the recent trial trip of the twin-screw steamer "Ceres." This vessel is built without a double keel, a three-bladed screw working under each quarter. The screw shafts are supported outward by means of V brackets just in front of the blades. The engines are horizontal direct-acting; the cylinders, which are cast in pairs, being placed nearly over the keel, with the condensers, which are of the ordinary injection variety, between their ends and the ship's side. The air-pump buckets are worked by a prolongation of the main piston rod through the cylinder bottoms. The starboard engine is placed forward; the shaft of the screw on that side running between the bottoms of the larboard cylinders and their condensers. The framing of the engines is very neat and compact; and the engine room one of the most convenient we have ever seen. A small fan is fitted inside the stoke-hole bulkhead, in order to aid the draft in the furnaces, which it does effectually; the boilers making an abundance of steam with very moderate firing. There can be no doubt that the subdivision of a certain amount of power among a number of cylinders affords peculiar facilities for the construction of engines intended for screw propulsion; and not the least advantage attending the use of two screws is found in the fact, that the position of the screw shaft permits the employment of a connecting rod of fair length attached directly to the piston rod. The use of the V brackets, however, cannot be regarded as commendable. Not only do they offer very great resistance to the motion of the hull through the water, but the peculiar position of the screws, with their inner blades only removed a few inches from the keel and dead wood, at each side of which they work, injures their action very materially, causing a good deal of vibration, and preventing a clear run of water to the blades. In order to overcome these objections, Commander Symonds, R.N., in a Paper on the Construction of Screw Steamers, read at the Royal United Service Institution in March, 1862, advocates the use of two hollow keelsons, each containing a screw shaft. The dead wood in the centre being done away with, a half-rudder is fitted to each keelson under the screw shaft—a mode of construction which would, we imagine, effectually overcome most of the objections at present raised against the use of double-screws.

We begin, at last, to understand that the ship which can steam at the greatest speed on the lightest draught of water, and manœuvre with the most ease, must be the best for all the purposes of warfare. Were the use of armour-plating and heavy guns confined to the British Navy, the question of speed would be of secondary importance: our ships being comparatively impregnable could set an enemy at defiance. Other nations, however, have resorted to the same principles of construction as those we have adopted. Guns and armour-plates are not peculiar to our ships; and modern navies are, after all, very much in the same position, as to their relative powers of attack and defence, as that which they held half a century ago. If the strength of modern war-ships has been immensely increased within the last few years, so have been their powers of destruction; and a sea-fight would be now, more than ever, a question of naval tactics and rapid evolutions. Under sail alone, none of our large frigates can be depended on either to stay or wear; some of them requiring three miles for the former and seven for the latter. Under steam they perform better; still the operation of turning is tedious in the extreme, and cannot be accomplished in crowded or narrow waters without considerable danger. The use of two screws would enable the largest ship in the Navy to turn on her own centre as on a pivot, placing her really under the control of her officers. It might, indeed, be practicable to construct a very efficient fighting ship on this principle, armoured at the bow alone with plates, thick enough to set a shot at defiance, and carrying a couple of 150 lb. Parrot guns there. Such a ship would be a match for almost any single adversary, from the ease with which, turning as on a pivot, she would always present her armed head to the foe. If very large guns are ever to come into use, it will only be by mounting them on the ship as a gun-stock and training them by changing her position.

The principle on which the success of Mr. Dudgeon's craft has depended, is neither new nor untried. In 1845, Ericsson built a small double-screw steamer for the Marine Insurance Companies of Boston, U.S. This vessel was used for many years in and about that harbour, for the purpose of rescuing ships which had got into dangerous positions. She could navigate the most intricate passages with the greatest ease by means of her screws, turning in her own length in a remarkably short space of time. The Insurance Companies calculated that she saved them many millions of dollars during her career. On one occasion, she rescued one of the Cunard steamers from a very dangerous dilemma, and brought her safely into Boston harbour. She remained in that service until the commencement of the war, when she was purchased by the Federal Government and fitted as a gun-boat, in which capacity she did good service until she was wrecked last winter. The "Nangatuck," an American gunboat, repeatedly turned end for end, during public experiments, in 1 min. 15 sec. She was fitted with twin-screws, and had a single 100-pounder Parrot gun on a fixed carriage, there being no possibility of moving the gun laterally, except by turning the ship. The celebrated Stephens' battery, with fixed turrets, is also fitted with two screws, worked by independent engines. The system is, in fact, rapidly extending in America.

The question, therefore, for our Government is no longer, whether it will or will not take the initiative in the introduction of a new principle, but whether it will follow the example set by other nations. Thousands of pounds are wasted annually on costly experiments which frequently result in nothing. But the twin-screw principle is objected to in very nearly the same words as those employed in the reply to Ericsson, when he urged the adoption of the screw-propeller on the Lords of the Admiralty—namely, "that the paddle-wheel answered their purpose sufficiently well." The single screw also answers their purpose, we are informed; and the only experiment which the Government will make, is the construction of a double-screw boat of 30 tons burden! We really imagine that, with the example of a private firm already before them, the Lords of the Admiralty might have adventured a few thousand pounds on a ship large enough to go to sea and face a gale of wind, instead of a few hundreds in a miserable little craft, more suitable for a pleasure-yacht, than for the first official embodiment of an important principle. Those in authority maintain that the screw must be regarded more in the light of an auxiliary power, to be rarely employed, than in that of a permanent means of propulsion—in other words, the Lords of the Admiralty state that the work of the fleet must be done by sails, and that therefore, from some ideal difficulties connected with the elevation of double-screws, they are unsuitable for use in the Navy. The absurdity of this conclusion has rarely been surpassed. The screws can be raised, on Captain Symonds' principle, with the greatest ease; and even if they could not, they could either be disconnected, feathered, or driven by donkey-engines. With her screws up, a double-keel vessel really becomes a good sailing ship, which the single-screw ship never can, in consequence of the injurious effects of the opening in her dead wood, and the resistance caused to her progress by the after stern-post dragging through the water. As to the expediency of sacrificing much that is valuable, in order to retain the power of converting a good steam-ship into a bad sailing one, we do not wish just now to express an opinion. By a recent dictum we learn that sails could probably be dispensed with, provided the ship could carry thirty days' coal—an object which, we imagine, may yet be secured without very great difficulty.

V. P.

GREEK FIRE AND TORPEDOES.

As yet, engineers have had all their own way in the recent extension of the powers of destruction; chemists have practically done but little beyond the invention and improvement of gunpowder. The latent powers of destruction in many substances known to modern

chemists are, however, immense, and it is not improbable that the chemical knowledge of the 19th century may some day bring forth a similar revolution in warfare to that effected by the chance discovery of gunpowder by the alchemists of the Middle Ages. To the development of chemical destructive power, directed by the modern resources of engineering, we may, perhaps, look to the realization of the hope that war may be rendered a physical impossibility. We say *perhaps*, as the realization of this hope—the specious balm self-administered by all the conscience-stricken inventors of implements of warfare—has always appeared to us more than doubtful. Given two rival armies or navies, each provided with an infallible wholesale and instantaneous means of destruction. Would not each party hope and trust that it may be beforehand in the application of the wholesale death potion?

However this may be, we already see at Charleston in the Federal bombs charged with Greek Fire, and in the infernal machines used by the Confederates—two distinct applications of a warlike union of chemistry and engineering. The exact composition of the Greek Fire with which the Federal shells are charged, is naturally a secret; the prevalent opinion seems to be that it principally consists of either naphtha or spirits of wine. That this is the case, we have lately obtained some corroborative evidence. In searching through an old book—the "Natural Magick," of Baptista de Porta—published in Italy towards the middle of the 16th century, we alighted on the following recipe and short history of "Greek Fire," which we copy *verbatim* as follows:—

By the subtilty of the Greeks there was invented a fire, called Greek Fire. To overcome the ship, presently, they boyl'd Willow-coals, Salt, Spirit of Wine, Brimstone, Pitch, with the Yarn of the soft Wool of Ethiopia, and Camphire; which, it is wonderful to speak, will burn alone in winter, consuming all matter. Callimachus, the architect, flying from Heliopolis, taught the Romans that thing first, and many of their Emperors did use that against their Enemies afterwards. Leo, the Emperor, burnt with this kind of Fire those of the East, that sail'd against Constantinople with 1,800 Camels. The same Emperor, shortly after, burnt with the same Fire 4,000 ships of the Enemy, and 350 in like manner. Prometheus found out that fire would keep a year in the Cane Ferula: wherefore Martial speaks of them thus:—

Canes, that the Master's love, but Boys do hate,
Are by Prometheus's gift held at a great rate.

It will be seen that, what druggists call the "vehicle," by which the ancient Greek Fire was administered, consisted simply in a "kind of tow or yarn." This would, no doubt, answer well enough against wooden ships; the Americans, however, have naturally filled their bomb-shells with this destructive composition.

In the following passages, it will be seen that the Mediæval Italian *savant* has also anticipated the Confederates in the construction of naval infernal machines. Indeed, in many situations, Baptista de Porta's infernal machines would probably be more efficacious than those of General Beauregard—especially in shallow situations. A torpedo of this kind, fired by means of the galvanic wire, would probably effect great havoc in a fleet.

Baptista de Porta's plan will be found described on the 298th page of his book, under the title of "*How in plain ground and under waters mines may be presently digged:*"—

You shall make your Mines where the enemies' Galleys or Ships come to ride; you shall upon a plain place fit many beams, or pieces of timber, fastened cross-wise, and thrust through, or like nets; according to the quantity in the divisions, you shall make fit circles of wood, and fasten them, and fill them with gunpowder; the beams must be made ..., and be filled with match and powder, that you may set fire to the round circles; with great diligence and cunning, smear over the circles and the beams with pitch, and cover them well in it, that the water may not enter, and the powder take wet (for so your labour will be lost), and you must leave a place to put fire in; then sink your engine with weights to the bottom of the water, and cover it with stones, mud, and weeds, a little before the evening come. Let a Scout keep watch, that when their Ships or Galleys ride over the place, that the snare is laid; for fire being put to it, the sea will part, and be cast up into the air, and drown'd the ships, or will tear them in a thousand pieces, that there is nothing more wonderful to be seen or done. I have tried this in waters and ponds, and it performed more than I imagined it would.

MILLS AND MILLWORK.*

A century of mechanical engineering has not only introduced novelties in manufacturing processes, and the machines by which they are accomplished, but in our mechanists and that literature peculiarly their own. It does not need a very extended retrospect to recall the days when everything connected with prime movers, wheel-work, or mechanical appliances, dwelt in the hands of a class styled "millwrights," men as different in abilities, skill, and social habits, from any we now meet with, as it is possible to conceive. Illiterate and conceited, drunken and unmannerly, their presence was tolerated only because nothing better was to be had. Few and far between were the exceptional cases, wherein the faculty of "millwrighting" was coupled with that accurate knowledge of first principles, and a correct perception of their bearing on every point presenting a difficulty, which elevates the mechanic into the engineer. A few lights gleam through the darkness only to make the darkness itself still blacker; and it can scarcely be maintained that these men, as a class, have become merged in something greater and better. The modern mechanical engineer is almost a creation, scarcely a growth; and if this be true of the men, how much more so is it of their books. Fifty years ago a young man, studying what was scarce a trade, yet not yet arrived at the dignity of a profession, had no means of acquiring knowledge but personal observation. Within his own district the same arrangements of gearing, style of building, and constructive principles were repeated over and over, with a stereotyped uniformity, which gave opportunity for the acquirement of not one single novel idea; and travel alone, by bringing the youth into different scenes, and in contact with other men, could convert the servile imitator, into one, capable of originating new ideas, and developing them to a successful result. The knowledge to be derived from books was trifling. Not only were they expensive and rare, but a misty style of composition obscured the authors' meaning, and detracted materially from the usefulness of a class of literature, which was otherwise not without a certain value. Theoretical knowledge can never be disseminated without books; and without theory, it is difficult, indeed, to secure correct practice. In our day, we have little to complain of on this score; and the youth of this half of the 19th century might possibly become a very fair engineer, capable of designing, if not constructing, any machinery however complicated, without any workshop practice. Scarcely a subject coming within the range of the arts is left untouched. Able and exhaustive treatises, popular essays, newspaper articles, have brought mechanical science from the workshop to the fireside and the lecture-room; and, to books in vast degree, must be attributed the perfection of our steamboats, our railways, and our factories. Much of the time heretofore spent in manual labour, is now more usefully employed in study. Some will always have to design, while others find their mission in executing the works appointed them. Thought begets thought; and the progress of science is so rapid, that the field for engineering literature daily expands; and those books which comprise most practical information, well digested and arranged within the smallest compass, are certain to be regarded as most valuable. As a sample of such a book, it is perhaps difficult to select one better adapted to its end than that now before us. "In the first part of this book," says Mr. Fairbairn, in his preface to the present volume, "I endeavoured to give a succinct account of nearly fifty years' experience in the profession of a mill architect, millwright, and mechanical engineer. My professional career commenced just at a time when the manufacturing industry of the country was recovering from the effects of a long and disastrous war; and I was enabled from this circumstance to grow up with, and follow out consecutively, nearly the whole of the discoveries, improvements, and changes, that have since taken place in mechanical science." Mr. Fairbairn's name stands so high, that such an explanation of the causes, which gave him a peculiar fitness for writing a book on millwork, is hardly necessary. The reputation he has already earned as an author, is security that any work emanating from his pen will be valuable.

The first volume of "Mills and Millwork" was published in 1861. Commencing with a chapter on the Early History of Mills, the author treats successively of the principles of mechanism, of the accumulation, outflow, and discharge of water, the construction of water-wheels, turbines, &c., and concludes with a treatise on the steam-engine and boilers, and a chapter on windmills. The second volume, only published a few weeks since, is fully equal to anything Mr. Fairbairn has ever written. The first part is devoted to the consideration of machinery of transmission. The article on the teeth of wheels in this section is exhaustive and interesting, giving not only the rules for their correct formation, but the reasons for them, in a form which leaves little to be desired. Mr. Fairbairn very properly dwells on the importance of proper curves to the correct working of any train of gearing, pointing out the ease with which they may be secured by the use of the odontograph, a little instrument we could wish to see in more extended use than it is. The section is illustrated with a useful plate of examples of teeth, mostly drawn to full-size scale, on the different systems met with in the best practice. The second chapter, on the strength and proportion of shafts, is extremely able—we fear too much so—the author treating his subject in a style which would have been far too theoretical, were it not redeemed by practical tables calculated to meet every ordinary case. This section concludes with a chapter on engaging and disengaging gear, which scarcely leaves a single form of such apparatus undescribed.

In the fifth section which forms the second part of the volume before us, Mr. Fairbairn touches lightly on an important subject, too much neglected—Mill Architecture. We are rapidly drifting into a state of total disregard for the ornamental in such buildings as are intended to contain machinery; and our author might have extended this chapter with considerable advantage. It really requires no additional outlay worth naming to render a building—pro-

* "Treatise on Mills and Millwork." By William Fairbairn, Esq., C.E., LL.D., F.R.S., F.G.S. London: Longman and Co. 1863.

bably the most prominent feature in the landscape—pleasing to the eye, as well as adapted to the object in view. Mr. Fairbairn is an engineer, however, not an architect; so we hasten with him to the chapter on Corn-mills. The two which the author has selected as examples, are one of three pairs of stones erected at Constantinople for the Seraskier Halel Pasha in 1842, and the other of thirty pairs of stones, for a Russian Company at Taganrog, on the borders of the Black Sea. The first was built under the conditions that the building should be entirely of iron, that it might not be burnt to the ground by the fires which so frequently occur in the Turkish capital. The other was intended for the purpose of grinding the large supplies of wheat which are grown on the Steppes of Southern Russia for the European markets, and also for the supply of bread and biscuits to the Russian Navy. The descriptions of these mills are very copious, and accompanied by tables of the gearing and speeds of every shaft and wheel, from that of the prime mover to the sack tackle pulley—a feature as novel as it is valuable. Mr. Fairbairn pronounces strongly in favour of the bevel-wheel system—a sentiment with which most engineers will agree, as the disadvantages of spur-wheel hursts are very well understood. It is very remarkable that he should not once allude to the system of blowing air through the stones to keep the flour cool, the use of a stive-room, or, indeed, several details which are considered matters of necessity in a first-rate flour-mill of the present day. Nevertheless, the chapter cannot fail to prove useful to those interested, embracing as it does practical examples of machinery which has proved extremely successful.

During the Russian war, Messrs. Fairbairn and Sons were employed to fit up two screw steamers, the "Bruiser" and the "Abundance" as floating corn-mills, which they accomplished with perfect success in less than three months. Our author devotes a little space to a description of these mills, which were, perhaps, the first of the kind. The machinery was all driven from the propeller shaft, and the whole of the process performed without manual labour The wheat was stored in the fore hold; the four pairs of stones being arranged in a line directly over the screw shaft abaft the engines, and driven from it by bevel gearing. Ten sacks of flour per hour were frequently ground while the ships ran at the rate of 7¼ knots in the same time—a rather remarkable feat.

Mr. Fairbairn does not confine his observations to corn-mills. The latter half of the volume before us treating consecutively, at some length, of cotton, woollen, flax, oil, paper, powder, and iron mills; the architecture, fittings, and machinery of the two first being dwelt on with a care, which renders these chapters not less interesting than useful. In pursuance of the system generally adopted through the work, examples of mills in successful operation are selected as illustrations of correct principles of construction: plans and sections being supplied of the large factory built by Messrs Fairbairn for the Oriental Cotton Spinning and Weaving Company, near Bombay, and the Izmet Woollen-mills, erected by the same firm, for the Sultan, near the Gulf of Ancient Nicomedia. Flax-mills are illustrated by a mill erected at Narva, in Russia; while the new machinery at Waltham Abbey, serves the same purpose for the chapter on Gunpowder-mills. The entire work forms a most valuable book of reference. The engineer, even if inexperienced in the construction of any particular class of machinery, need never be at a loss for the correct solution of a minute question of detail. The tables interspersed through the book, give the speeds of all the machines treated of, from the smallest to the largest; while general information is put before the reader, in a pleasing and accessible form. We can cordially recommend the book to the mechanical engineer as one of the best of its kind. V. P.

HEAT.*

It is impossible to conceive of anything more intimately connected with, not only our well-being, but our very existence, than that principle of nature termed Heat. Mysterious in its attributes, strange in its powers, and remarkable in their development, heat has, for centuries, baffled the wisdom of the greatest philosophers. Amidst the host of treatises which have been written on the subject, the one before us deserves to take a place as one of the most remarkable, if not exact, and complete, which has yet appeared. Starting on the assumption, which he takes some pains to prove correct, that all previous hypotheses are incorrect and unsatisfactory, the author places yet another before us, in very remarkable language. Without asserting for a moment that his theory is perfect, his reasoning leads us to believe that it is, on many points, more satisfactoy than any which has gone before. Faraday was one of the first to enunciate the idea that force can have existence without any connection with matter. This view Mr. Colburn embraces and applies to heat. Successively reviewing and abandoning the material, motory, and molecular vortical theories, he considers heat as a pure abstract force, to some extent analogous to gravity. Most of the conclusions which he draws from these premises are, doubtless, correct. There is not a theory of heat in existence which is not open to objection in some respects. Perfect in some things, falling short in others, each seems to want what another can alone supply. The present is not an exception to the rule; still we welcome the book, because it throws light on many obscure things, and the author's propositions are, for the most part, very carefully reasoned out. The language is, perhaps, more suitable to men of science or philosophers than to engineers as a class. Yet many who are not very deeply versed in the mysteries of natural philosophy may read this little book with advantage; while to those who are, we recommend it as containing much food for careful thought.

* "An Inquiry into the Nature of Heat." By ZERAH COLBURN. London: Spon. 1863.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

The October meeting of this society took place on the night of the 3rd inst., at 35, St. Swithin's-lane, City. Mr. Joseph Newton, of the Royal Mint, occupied the chair; and the proceedings were commenced, as usual, by the reading and confirmation of the minutes of the preceding meeting. Afterwards the Chairman read a communication from M. Achard, C.E., in reference to sundry queries which had been put, but not answered, when, a month before, Mr. Gettliffe communicated his Paper on "Boiler Explosions and Railway Accidents." It will be remembered that M. Achard's apparatus, then described, was intended for the maintenance of a constantly level feed in steam boilers; and the first of the queries ran as follows:—"If the float, refusing to act, causes the index to remain at zero, while the water falls in the boiler, how can the alarum bell, in consequence of the non-interruption of the electric current, be made to give the required signal?" The answer to this objection was, that in M. Achard's arrangement a stone float was immersed in the water with a counterpoise on an exterior shaft. The articulation consisted in the friction of a steel roller on a plane of polished cast iron, instead of the old stuffing-box system, which was in many respects imperfect and liable to derangement. The resistance of the rolling friction was insignificant as compared with the gravitation of the stone float, and with that of the exterior counterpoise weight. The float known as "Bourdon's" also neutralized the objection raised; for it was scarcely possible for it to refuse to work freely, and it indicated alterations in the water level to the minute difference of 1-24th of an inch.

In reply to the second question raised—"Would it not be possible to cause the conducting wire to pass through the boiler, and communicate directly with the float?" M. Achard stated that the plan would be quite practicable. He had carried it out with success at Lyons, in the manufactory of Messrs. Coignet. In that case, the conducting wire was subjected to continual friction, which prevented oxidation, and the current circulated quite as freely as with Bourdon's float. The disadvantage of the arrangement, however, was that it precluded the application of an indicator on the face of the boiler, which was legally imperative in France. The Bourdon float, therefore, superseded it, and it met every requirement.

The third of the series of queries was—"Which would be the best and most economical means of keeping the automatic regulator in operation during the temporary stoppage of the machinery and the absence of the workmen?" It was replied that, in order to secure this desideratum, which had not escaped the early consideration of the inventor of the regulator, he had at first added to it a direct electrical bell, which rang the alarm by means of the circulation of the electrical current, so that when the current no longer circulated for the regulator, it circulated for the direct electrical alarum—this latter operating notwithstanding the suspended action of the machinery. Of course the alarum in such case might be fixed in any convenient place—the office of the manager of the factory, for example. It had been found that this was but an extra precaution, which it was not absolutely essential to take, for the water in the boiler never descended, during such temporary suspension, more than an eighth or a quarter of an inch. A little reflection, indeed, would show that when an engine was stopped *pro tem.*, the index of the regulator pointing to zero, the water could not, owing to the non-consumption of steam, decrease more in height than had been stated.

The querists having acknowledged themselves satisfied with the explanations of M. Achard, the Chairman next proceeded to revert to the loss which the Association had sustained by the decease of one of its honorary members, Mr. William Buckle, of the Mint. In feeling terms, the last hours of his late colleague were described by Mr. Newton, who read also a brief sketch of the deceased gentleman's life and career as an engineer. Mr. Buckle was born, he said, at Alnwick, Northumberland, July 29, 1794, and was educated at Hull, in Yorkshire. Soon after he had left school his parents removed to London, and he was apprenticed to Messrs. Woolf and Edwards, millwrights and engineers, of Holland-street, Blackfriars-road. His conduct during his apprenticeship was exemplary, and his evenings were spent, for the most part, at a drawing school in Finsbury. In the year 1817 Mr. Buckle went, at the instance of Messrs Humphrys, to Memel, to establish steamboats on the rivers and lakes of Prussia, under the patronage of the Prince of H..r..lenburg. Whilst in that country he was fortunate enough to save from drowning a young lady of the Prince's family, and to receive for his valorous conduct a gold medal. Mr. Buckle remained at Memel for four years, and returning at the end of that time to England, was entrusted with the charge of the engines of the first steam mail packet between England and Ireland *via* Holyhead and Dublin, under the then Postmaster-General, Sir Francis Freeling. In 1820 he superintended, so far as his special department was concerned, the voyage of George IV. to Ireland, in a steamship then known as the "Lightning." The name of this vessel was

ubsequently exchanged for that of the "Royal Sovereign," and afterwards, *mutatis mutandis*, for that of the "Monkey," under which last designation she now does duty in the Thames as a tug-boat! Mr. Buckle, after having safely conducted "the first gentleman in Europe" (save the mark) back to England, was engaged by Messrs. Boulton and Watt as manager of their engine works at Soho, near Birmingham. In this capacity he remained for the space of 33 years, enjoying during that lengthened period the friendship of his employers, as well as of the numerous *savants* who visited in succession that shrine of science, "Old Soho." In 1851, Mr. Buckle, having followed to the grave the original partners of the eminent firm in question, transferred his services to the Royal Mint. At this establishment important changes were at that time made. A Royal Commission had recommended the removal from their posts of the Company of Moneyers; and the Government acting upon the recommendation, pensioned off the members of that company; the place became, therefore, exclusively a national establishment, and Mr. Buckle was appointed one of its principal executive officers. That post he occupied up to the day of his death, although failing health had, for many months previously to that event, prevented his active performance of duty. During those months the reader of this brief sketch had the honour of officiating at the Mint for his disabled friend and colleague; and perhaps no one had been able more fully to appreciate the kindly disposition, the amiable temper, and the practical talent of the deceased gentleman than himself. It would be possible to enumerate many [remarkable mechanical works in which Mr. Buckle was engaged during his managerial career at Soho; but as it was likely that these would be referred to at length in a memoir which was being prepared for publication, it was not necessary to particularize them.

Much emotion was exhibited by Mr. Newton in the reading of the above, and the general feeling pervading the members at the time was evidently one of extreme sorrow. Finally, it was proposed by Mr. Oubridge, seconded by Mr. Jones, and unanimously carried, "That the Secretary should be directed to convey in writing to Mrs. Buckle and her two children the condolence of the Association of Foremen Engineers under pressure of their heavy bereavement."

On the conclusion of this painful episode in the proceedings of the evening, Mr. T. Miller read a very elaborate Paper on an "Entirely new Method of Coating Telegraph Wires." This was illustrated by a series of admirably-finished diagrams, and was replete with interest. At a future period we may give an extended report of this communication; but lack of space at present compels us to summarize its principal features. Mr. Miller proposes to cut sheets of india rubber from blocks in such a manner that the knife-cuts or corrugations shall run in a longitudinal direction, or nearly so, with the sheet. He has also constructed an apparatus for preparing the strips for the covering machines, as well as covering machines themselves. In the latter, the principal points of improvement consist in the employment of sets of hollow spindles placed one within the other and to be driven at different speeds. A third arrangement is the drawing or stretching apparatus mounted on spindles and to act independently of the friction of the bobbin on its spindle. Another main characteristic of the series of ingenious contrivances in question is, the application of a current of electricity, by the action of which the working of the covering machine will be self-actingly stopped when the insulation is imperfect.

The Chairman remarked, at the conclusion of Mr. Miller's Paper, that he had rarely heard a more complete description of a variety of ingenious combinations of machinery, for the effecting of an important object, than that which he had just listened to. In every way Mr. Miller deserved their thanks—in the first place, for the demonstration of his skill as a mechanic and draughtsman; and in the next, for the clear and intelligible way in which he had put the whole subject before the meeting.

A vote of thanks having then been put and carried, *nem. dis.*, the members of the society separated.

SCIENTIFIC GHOSTS.

By H. Dircks.*

Sir David Brewster has judiciously remarked that, "although it is not probable that we shall ever be able to understand the actual manner in which a person of sound mind beholds spectral apparitions in the broad light of day, yet we may arrive at such a degree of knowledge on the subject as to satisfy rational curiosity and to strip the phenomena of every attribute of the marvellous." I cannot say of the work in question that the many ingenious illustrations given as the result of natural phenomena or scientific combinations lead to the anticipated result, for in every instance adduced the aerial or spectral figures are but isolated visions, or, when produced artificially, are of very limited application.

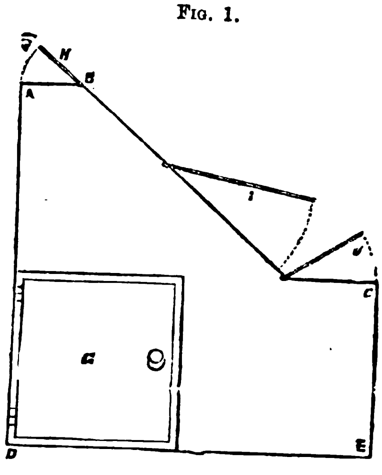
The peculiar features of the optical arrangement I introduce may be thus stated:—Two or more figures, for example, appear on a stage, and the spectators view them as two living actors, in all respects the one as well defined and obviously round and life-like as the other, yet one shall be a material and the other only a visionary actor, results obtained in a manner by no means in accordance with the before-named views expressed by Sir David Brewster. We may suppose a theatre or apartment, arranged as customary when required for dioramic exhibitions, a stage being provided and the spectators placed in a distant, darkened, and elevated portion of the building. The spectators, thus situated, may, for example, see on an illuminated stage two or more figures, but without being aware that one or more of them bears a visionary character. The peculiarity of this mode of exhibiting spectral appearances, it will be understood, consists in thus associating a living or solid figure with a merely visionary one, and yet the illusion to be so well sustained that the spectator distinguishes no visible difference between the several actors when properly managed until the circumstances of the dramatic scene require the visionary figure to fade away or pass through the furniture and walls of the apartment, or play any similar spectral part.

It is more than twenty years since I first invented a plane mirror of unsilvered glass, but, finding no practical utility in the contrivance, it was laid aside. It happened, however, that within the last two years I accidentally observed a solid body in a peculiar situation, by which it was apparently rendered transparent. It was, in short, an effect illustrated by my plane unsilvered glass mirror in its principle. I immediately saw that by means of this combination the singular appearance could be produced, of getting behind a mirror and communicating with its shadows. Here, then, a means was at once at hand for producing the best possible illustrations of all descriptions of spectral phenomena. For this purpose I arranged an oblong chamber into two equal portions, making the separation between the two by means of one vertical screen of thin glass, having a perfectly true surface. We may suppose each chamber to measure 12 feet square and 12 feet high. Now, let one of these be the stage in which the acting is to take place, its floor and three of its walls are solid, and the fourth or front of it is one entire glass screen: the ceiling must be made to open at different parts to let in light, and have suitable blinds to regulate the light and shade in which the actors perform. The chamber opposite, or facing the actors, is in reality a second stage for carrying out the spectral performances, and is differently constructed; the two sides may be large folding or sliding doors, or may be left quite open, or one side closed and the other open, but the ceiling must cover only that half of the top away from the glass screen or partition, thus leaving an open space in the ceiling of 6 ft. by 12 ft. Through this space so left in the ceiling the spectators obtain a full view of the stage, their seats being above the half-ceiling described, and thrown rather backwards than forwards; the line of vision thus being at an angle of about 45 degrees with respect to the vertical glass screen or plane unsilvered crystal mirror. It will now be obvious that the actor on the stage beneath the seats of the spectators can only be seen by reflection, and the trained actor in the opposite stage, knowing the precise situations of the reflection as seen by the spectators, performs accordingly, so that, when really seeming to stand confronting the vision, the actor whose reflection is thus seen as a vision, is as far from the screen on one side as his reflection is cast in the other.

Some striking effects may be produced illustrative of the illusive properties of optical apparatus constructed on the principle described. Thus, a figure placed before a white screen is so strongly reflected that the spectator cannot divest his mind of there being the substance and not the shadow, which he observes, particularly as he contrasts them with an adjacent solid figure. By placing two figures of corresponding form equidistant, one on each side of the glass mirror or screen, they appear as one, until one is moved; and if they differ in colour, as one blue and one white, the effect seems more remarkable. If a cabinet, box, or the like is placed one on each side of the mirror until the image of one exactly corresponds with the material figure of the other, then the spectator may see the visionary figure open a drawer or door and remove and replace anything therein, and afterwards the solid figure repeat the same acts. If the reflection of an actor is thrown on a transparent screen it is invisible, but by gradually decreasing the light the spectral appearance will be as gradually developed, until apparently it becomes a firm, solid figure in all its proper costume, and acting in perfect conformity to its designed character.

The arrangement of the apparatus is represented by the annexed engravings. Fig. 1 is a side elevation, fig. 2 a vertical section, and fig. 3 a plan. A B C D E is a box closed on all

Fig. 1.



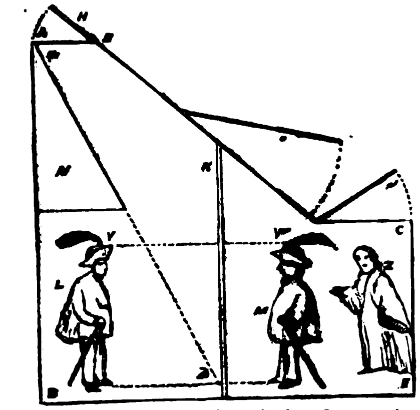
sides, but provided on one side with the door F, and on the other with the door G, hinged to the back, A D; and on the top of the box are the flapped openings H, I, J. The interior of the box is divided centrally by the partition K K, made of a good, clear, and even-surfaced piece of thin patent plate glass, kept in its place within two side grooves. The box is thereby divided into two separate chambers or compartments, L, M, the latter, M, having a ceiling or screen, N, to exclude any object therein from the direct view of the spectator, as shown by the line *a b*.

If two figures be now introduced, one Y, the other Z, and the eye of the spectator be fixed at A, he will observe two images, one the real figure Z,

* Read before the British Association, 1858.

the other Y', the mere reflection of Y. By this arrangement it is evident that the plain unsilvered glass thus viewed at an angle of about 45 degs.

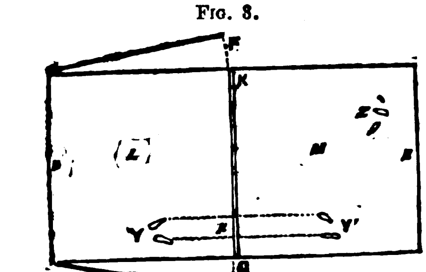
Fig. 2.



has all the properties of a mirror, but, owing to its transparency, two figures are seen possessing little or no distinguishable difference between them. Of course a person placed at Z sees only the figure Y; but as a piece of acting he may, under proper arrangements of a suitable stage, approach the situation apparently occupied by Y', and thus indicate to spectators placed at A any pre-arranged dramatic scene requiring Z to be in correspondence with the visionary figure Y'.

In using the apparatus, the flap H must be open, but I may be shut, being mostly useful to get admission for inserting or withdrawing the screen or the figures. The flap J may be closed or opened to regulate the admission or exclusion of

Fig. 3.



light. The two doors, F, G, may both be wide open, though one is generally sufficient, provided it is turned as direct as possible to the light. A mirror placed at an angle close to the opening F or G will assist the illusion by illuminating the figure Y, and thus heightening the effect of the reflection Y'.

If two geometrically proportionate figures, as spheres, cubes, or the like, be placed in the situations Y, Y', then the image at Y' will be a vision and a substance combined, as will at once appear by slightly moving the substantial body in either compartment, L or M. Let the duplicate figure be a box, and then the spectator might observe the apparent anomaly of the same box being opened and a substance taken from it and replaced either by a substantial or a visionary actor. When the compartment M is lighted up no vision appears, but, the light being made gradually to fade and disappear, the vision might seem life-like as at first. As it is evident that the right hand of the vision is the left hand of the actor in the compartment L, all his acts requiring the right would have to be performed with the left hand, to appear natural to the spectator. It is also requisite for ensuring a good effect that no solid figure in the compartment M should come before or behind the visionary image, as its transparency would at once become evident; but, if anything of the kind is desired, then the background figure or object should be placed behind the actor Y, and become with him also visionary. In this way a white screen placed behind the actor Y will allow his shadow to appear on it, and give great force and solidity to his reflected figure or vision at Y'.

TIME SIGNALS AND CHRONOMETERS.

By Mr. James Mather, of South Shields.

In the earliest ages the mariner had no means of discovering longitude; and, once on the broad ocean, his distance from land, or his whereabouts, was an enigma. Even after the compass was known, the voyages of European navigators, up to the end of the 15th century, seemed little better than coasting voyages along the shores of Europe and the Mediterranean, and even round the African continent and the Cape to India.

At the time of Columbus, longitude, though better understood, yet relied on imperfect observations of the stars with very imperfect instruments, and afforded to the mariner not much increase of knowledge, and at length brought up the great question of ages. For upwards of three centuries it was the great practical difficulty of navigators—the source of abundant errors, and often of disastrous wrecks. Columbus himself seemed lost in his erroneous views of it, which affected his westward course and his principal conclusions, corrected long after by better knowledge and experience.

In the beginning of the 16th century, the pervading ignorance on this subject induced learned men to devote themselves to the teaching of nautical science, and the modes of obtaining astronomical longitude. All the maritime States became deeply interested, and Spain and Holland especially offered large rewards for the discovery of the best mode of ascertaining it. Now, the great discoverer, Galileo, entered into the arena, and by the power of his telescope and other means, in 1610, helped forward the great question. He lucidly laid down the true principles of it—using Jupiter and his four satellites as the European clock, to strike the hour, and mark the time, in heaven, for earth. Thus, far into the 18th century, rested the position of the question of longitude. England, from her frequent losses at sea, both in the navy and mercantile marine, then became roused to its importance; and her Parliament, on the presentation of an influential petition, put itself in motion. This petition stated that the discovery of a good method of finding the longitude would "prevent the loss of abundance of ships, and lives of men, as it certainly would have saved Sir Cloudesley Shovel's fleet" (on its return from its attack on Lisbon), "had it then been put in practice." Upon this, Parliament, the same year (1714), passed an Act for the appointment of a Board of Commissioners for Longitude, offering large rewards for the discovery of the best method of finding it; and Queen Anne herself took great interest in the subject. A great nautical impulse was thus given; and at last George III. was affected by it, and offered £20,000 for the same purpose.

During this period, Mayer's executors obtained a reward for his lunar tables, teaching nautical men, with astronomical certainty, the reading of the hours, the minutes, and seconds of the celestial clock, by the movements of its pointer, the moon among the stars. To examine this clock with accuracy was the difficulty. The single-image sextant at sea was imperfect and unmanageable. Hadley, in 1740, with a sextant of two reflectors and its double image, gave to seamen a true astronomical indicator of the exact position of their local habitation. This instrument still continues to them most important for the astronomical rating of their chronometers, and for giving confidence where doubt would often be shipwreck and death.

At length appeared on the scene a simple Yorkshire carpenter, with an acute and exact mind, working in silence, as great men and great discoverers ever do; and suddenly, in 1764, he announced the invention of a chronometer, the labour of his life, that afterwards became the prototype of all chronometers. It was taken to Barbadoes and back, and gave the true longitude throughout, within a quarter of a degree. He received the £20,000 reward; and we now reap the benefit of his labours. It settled the vexed question, and is now the mariner's guide. His chief improvements or principles for his chronometer consisted, as most know, in "the detached escapement" and "the compensation balace." The vibrations of the first constituted the equations of time, unaffected by the machinery of the chronometer. The second protected from irregularities of the change of temperature, and was attached to the balance spring—afterwards to the balance itself, by Le Roy and Arnold.

Greenwich Observatory, with the accomplished Astronomer Royal at its head, now gives forth the true time, received from astronomical data that never err, and then, demonstrating it daily to the eyes of men, flashes it on lightning wings to all parts of the kingdom, for the use of mariners and others, whose lives depend upon it, and whose property, as well as that of maritime England, afloat on the oceans of the world, are secured by it from danger.

Greenwich, then, is the polestar of longitude. The power to observe it in every part is an individual and national interest. The Tyne, inferior to no port, requires that it should be done here, for the sake of its interests and the honour of its jurisdiction. A ship's chronometer is only useful when it is in exact accordance with Greenwich time, and exactly rated. If so, it is safety of way to the ship; if not, it is a false guide, a delusion, and a snare. The importance, therefore, to chronometer makers and commanders of ships of an easy reference to Greenwich time, is palpable and undeniable. Chronometers in their delicacy are not unfrequently disturbed in their rates, even by the change from the room of their makers to the cabin of the ship. "In a large majority of cases, these discordant results," says the able astronomer of the Liverpool Observatory, in his last report, "are not so much from the difference of quality of the instruments, as from the method which is almost invariably employed of obtaining the rates on shore, and calculating the errors on Greenwich mean time at sea." Whether these errors arise from change of temperature, by which even the best chronometers will be affected, and give errors of from one to two seconds daily in a change of from 30 to 40 degs., or from the irregular motion of the vessel, or some other cause, seems not yet ascertained.

The energies and acuteness of our astronomers and mechanicians, which have already eliminated nearly all causes of error from this wonderful instrument, will doubtless eventually detect and remedy what may be left. The "Nautical Almanac," which is a gigantic work of astronomical observations and calculations, giving the relative positions of the sun, earth, moon, and stars, four years in advance, enables the mariner to rate and correct his chronometer at sea, when the state of the time and the weather will permit. In storms, however, in thick darkness, and in obscured heavens, these observations cannot be made; and as a few seconds fast or slow in the chronometer may be shipwreck and death, it is clear enough that the best adjustment and rating of it should be done on board ship. It was stated by the British Association in 1837 that the best chronometers differed sometimes from each other two minutes of time, and they added, that "these two minutes might cause a wreck." A case will illustrate this:—A ship left the Tyne for South America last year. The chronometer was rated in the usual way, and the recorded rating was given as one second five-tenths slow. The time of the chronometer was trusted to. However, after thirty days at sea, a lunar observation was obtained, when the chronometer was found, instead of losing time as given, to be gaining eight-tenths of a second daily. Here was an error of sufficient gravity to have caused a wreck, had this vessel, thus directed by a treacherous guide, trusted in it. Thus the absolute necessity of an opportunity for an appeal to the true Greenwich time by every commander of a ship proceeding on a foreign voyage is quite evident. The Tyne sends forth from her busy port more laden vessels than the Thames. Upwards of 20,000 leave her harbour annually, of which a large portion go to foreign ports, and necessarily require exact knowledge of Greenwich time for longitude. All the great ports—the Thames, the Forth, the Clyde, and the Mersey—already possess time balls or signal guns, falling simultaneously with that at Greenwich, or calling in a voice of thunder, or flashing forth to the eye of the deep-bound mariner the grand truth by which his course is to be guided. The practical advantages of time signals it is not, perhaps, necessary much further to develop. They are, however, well set forth by the following extracts of communications from scientific and practical men of eminence:—

"There is no doubt," says the Astronomer Royal, in a note to me of the 16th of January last, "that a public time signal of authoritative character is a very great convenience to all classes of persons whatever—greatest of all to those persons who have to use chronometers showing accurate time."

"With regard to the advantages of time signals for nautical purposes, there cannot be a doubt," says the astronomer of the Liverpool Observatory, June 3.

"By outward-bound vessels lying in the stream, as they occasionally do for three or four days, the Greenwich time is rated from the ball, as a check upon the rate given for the chronometers."—Messrs. James Moss and Co., May 19, 1868. These gentlemen are well known as large shipowners.

"I can say that the Board thought it desirable at

the time" (when this gentleman was a member of the Marine Committee), "and I was informed that the time ball was used by captains of sailing ships, and I have never heard any opinion given against it since it was established."—William Inman, Esq., manager of the New York and Philadelphia Steamship Company.

"The captain or chief officers could always check the error given" (that is, in the rating) "by the time ball, after the chronometer was taken on board."—Messrs. Hornby and Son, the largest chronometer makers in Liverpool, 1863.

"They have no doubt that ship captains generally take advantage of the time ball."—Messrs. D. and C. M'Iver, Liverpool, managers of Cunard's lines of American steamers, and large steamship owners, May 19, 1863.

"We beg to say that our chronometers are usually sent ashore to be rated, in the first place, because of the vibration produced on board by the almost constant working of the steam-winches in loading and discharging cargo; and, secondly, because the time ball is not easily seen from the dock where the steamers load. Vessels, however, which lie a day or two in the river before proceeding to sea, escape these disadvantages: to such the time ball is a great boon, and by them is extensively used."—Messrs. Bibby, Sons, and Co., Liverpool, most extensive steamship owners, and of great experience.

Why not such an advantage for the Tyne?

The River Tyne Commissioners, deeply interested in the maritime operations of their important river, with its 400,000 registered tons of shipping, the eleventh part of the whole of the United Kingdom, had their attention called to this subject in 1859, when a committee of its body was appointed to investigate the subject. An interruption of this investigation occurred for about three years by some unforeseen causes; when, again, the Commissioners last year re-appointed the committee for the same purpose. In such investigation, we were favoured with the able advice and assistance of Professor Airy, who, with the same adaptation of energy and power by which he laid the basis of measuring and weighing distant worlds at the Harton Pit, and adopting a mode for preventing loss of time in chronometers, fully developed to them the advantages, and pointed out the practical facilities of this great disideratum for the Tyne.

The committee had under consideration a suggestion that a time ball should be placed on the High Level Bridge, and a signal gun on the old Norman keep of Newcastle, which was considered to be sufficient for the purpose of indicating Greenwich time to the upper reaches of the river, and that either a ball or gun near Whitehill Point, to command the docks and harbour, which sometimes contain more than twelve hundred ships, would be enough for the diffusion of this true knowledge. The brilliant and successful experiment performed by the Astronomer Royal of Scotland, Professor Piazzi Smyth, at Newcastle, on the 17th of August, is sufficient proof of the easy adaptation of both ball and gun.

Mr. John Hewat, of Edinburgh, was the first to propound the advantage of a signal gun; and Professor Piazzi Smyth, with that penetration which distinguishes him, at once perceived its advantages, and, calling in the aid of Messrs. Ritchie and Sons, they proceeded with the *perfervidum ingenium Scotorum* which distinguishes their country, to effect its successful execution.

The Commissioners of the Tyne having obtained opportunities of examining the skilful arrangements at Edinburgh, they there found that, by the pendulum regulator of Mr. Jones, of Chester, the clock at the castle of Edinburgh was made to pulsate with the astronomical clock of the Observatory at the Calton Hill, 4,000 ft. away. At the same time, by the ingenious clock-trigger of Messrs. Ritchie, the 24-pounder at the castle was discharged at the same instant as the time ball fell at Calton Hill, marking Government time. Daily the booming and flash of the time-telling gun from the castle-rock of Edinburgh thunders and gleams over that great city and across the broad waters of the Frith of Forth, amongst its deep bays, and for many miles throughout the surrounding country. When its instant flash cannot be observed, its sound is a true guide to mariners; for by the law laid down by Herschel, that the velocity of sound, in a temperature of 62 deg., is 1,125 ft. per second, and with 1·14 ft. difference for every degree of variance from 62 deg., adding for an increase, deducting for a decrease, the exact moment of discharge is fixed. This practical lesson cannot be lost upon the promoters of this great object on the Tyne. All that are required for those operations, with certain additions for the signal gun, are expressed by Professor Airy, in his letters to the Tyne Commissioners, thus:—"The information given to you," states the Astronomer Royal, "is correct, that, at ten and at one time signals, equally accurate, are sent from Greenwich Observatory, with no interruption except that of a relay at Lothbury, every day. From our best companies direct with Edinburgh, it appears that, where the metallic circuit is complete, the whole time occupied in the passage between Greenwich and Edinburgh is less than the 1-20th of a second"—(the action of the relay cost, on one occasion, the 1-50th of a second). "If wires were always in good order and dry, there would be no difficulty in dropping the time signal by direct action at Greenwich. But, viewing the chance of failure of these saving circumstances, I should recommend that the Greenwich current should be used to give signals only to the telegraph office, by which the error of a clock, No. 1, stationed there, would be ascertained, and with this knowledge another clock, No. 2, would be adjusted, and this No. 2 clock would automatically drop the signal. You may take the hour or hours you like best. The usual hour (following the example of Greenwich, which was fixed by office convenience), is 1 o'clock p.m. You had better come here in the morning, to include 1 p.m. in your visit, and we will mention other points." To carry out these suggestions of Professor Airy, according to Mr. Latimer Clark, the experienced engineer of the Electric and International Telegraph Company, it would require to make a junction between the Greenwich Obervatory and the selected sites or stations at Newcastle, and that near Whitehill Point, costing abont £160; two time balls, costing each about £110, equal to £220; a very good clock at each station, each £25, equal to £50; the maintenance of wires between Newcastle and Whitehill Point, £10; the charge for daily electric communication, per annum, £40; total, £480. After which, £100 a year, or thereabouts, may be taken as the cost of keeping in repair and working these time signals for the Tyne.

The signal gun also contemplated, and already so completely demonstrated, will doubtless add something to the cost. The Tyne Commission, however, with the means and appliances at their command, have great facilities for successfully and comparatively inexpensively carrying out this great object. To the Astronomer Royal, Professor Piazzi Smyth, and other scientific men, this important question may be well left for their better knowledge and experience to elucidate.

CLARK'S IMPROVEMENTS IN PROJECTILES FOR ORDNANCE.

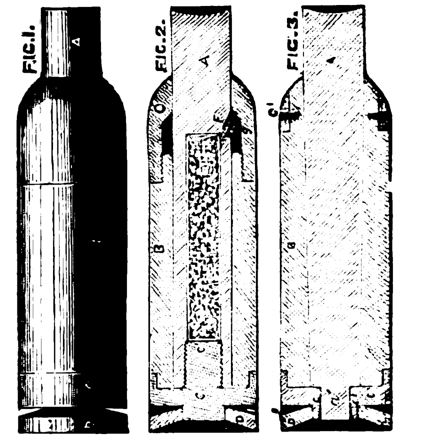
Letters Patent have been recently granted to William Clark, engineer, London, for an invention which relates to what are technically known as "sub-calibre" shot and shell—that is to say, shot and shell of a calibre less than that of the guns from which they are intended to be fired.

It consists, first, in the combination of a bolt or elongated shell of iron or steel, having a cutting face and a surrounding casing of wood or other light material; secondly, in a rear cap of metal, so applied in combination with the bolt or shell and the wooden casing as to serve as a means of holding the wooden casing, as a means of attaching the packing device, and as a means of supporting and guiding the rear end of the projectile in the bore of the gun; thirdly, in a front cap of metal, so applied in combination with the bolt or shell and the wooden casing as to serve the purposes of holding the forward end of the casing, of supporting and guiding its front end in the bore of the gun, and of effecting the explosion of the charge of the shell by resistance against the surface of the body penetrated by the shell itself.

In the accompanying drawing, fig. 1 is a longitudinal outside view of a shell constructed according to this invention; fig. 2 is a central longitudinal section of the same; fig. 3 is a central longitudinal section of a shot illustrating a modification of the invention. Similar letters of reference indicate corresponding parts in the several figures.

A is the bolt which forms the body of the shot or shell, made of cast steel or of iron faced with steel at its front end; and if intended for operating against metallic armour, its face is made concave, as shown in figs. 2 and 3, to produce a sharp cutting edge. For a shell, the exterior of this bolt may be made perfectly cylindrical, as shown in fig. 2, as the cavity for the charge may

FIG. 1. FIG. 2. FIG. 3.



be so arranged as to bring the centre of gravity nearer the front end; but for a solid shot, the bolt is tapered towards the rear end for about two-thirds of its length, as shown in fig. 3, to bring the centre of gravity to the desirable point. B is the casing of wood or other light material surrounding the bolt A, and extending from the rear nearly to the front end thereof, having a periphery of cylindrical form to fit the bore of the gun. This casing may be made to fit the whole space between the bolt and the bore of the gun, as represented in figs. 1 and 2; or for projectiles to be used in guns of large calibre may for the sake of ligthness be composed of staves secured around the exteriors of bands which encircle and fit snugly to the exterior of the bolt. C is the rear cap, made of malleable iron or other metal fitting over the rear end of the casing B, as shown in figs. 2 and 3. D is the cup-shaped annular disc of copper or other soft metal fitting over a projection c upon the rear face of the cap C, which projection is made of angular or irregular form in its tranverse section, to prevent the disc D turning on it. The cap C performs three functions—to wit, holding the rear end of the wooden casing, supporting and guiding the rear end of the projectile within the bore, and constituting the means for the attachment of the packing disc D. I represents hemp, candle-wicking, or other fibrous material, thoroughly saturated with a composition of tallow, black lead, and sulphur, coiled between the disc D and cap C, and when compressed between the said disc and cap it expands radially in all directions so as to assist the disc D in closing the windage. The composition above mentioned is likewise very beneficial in lubricating the bore of the gun and preventing heating and scaling. In the illustration given in fig. 2, the cap C also constitutes the means of closing the orifice through which the chamber of the shell is charged with explosive material, for which purpose this cap is formed with a projection c^1 adapted to screw into the chamber, the pitch of its thread being in the reverse direction to that of the lands or rifle grooves in the gun in which the projectile is to be used. The cap C may be attached to a solid shot by fitting it over a stem a^1 provided on the rear end of the shot and securing it by wedges c^2, as represented in fig. 3, or by upsetting or rivetting the said stem at the back of the cap. F (fig. 2) is a nipple, secured in an oblique position in the side of the shell. G is the front cap of metal, having a portion of its exterior cylindrical end of a size to fit the bore of the gun, and having in its front part a central opening to fit the bolt or body A so that it may turn freely therein. In the rear portion of the cap there is a screw thread to enable it to be screwed on to the front end of the wooden casing B, as shown in fig. 2, that it may hold the said end of the said casing in place, and support and guide it in the bore of the gun. The cap covers the nipple F. In the case of a solid shot, the forward end of the wooden casing may be held

by a simple metallic band slipped over its exterior and secured by screws V,V, as shown in fig. 3. The operation is as follows:—

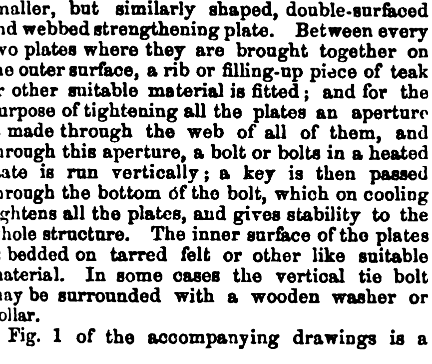
The charge having been inserted in any suitable form or manner, and a percussion cap put on the nipple F, and the cap G having been adjusted to a suitable position with respect to the nipple, the shell is ready for placing in the gun. The first effect of the carrying charge in the gun is to expand the cup-shaped disc D, forcing it and the packing and lubricating material I into the rifle grooves, and effectually closing the windage, and insuring a spiral motion of the shell as it is impelled forward through and from the bore, the screw C¹ being, in the meantime, tightened by the rotary motion received from the packing disc D. Owing to the great area exposed to the explosive force of the charge of gunpowder in the chamber of the gun in proportion to the weight of the shell, a very high velocity is produced, as is well known to be the case with sub-calibre projectiles. On striking any resisting body, such as metal armour, the small diameter of the bolt A causes its concave cutting face *a* to enter with great facility, and it passes in until the front of the cap G reaches the surface of the said body, and is arrested, when the momentum of the bolt continuing, carries it forward through the said cap G, and into the said body, the percussion cap on the nipple F is driven against the oblique inner surface *g* of the said cap G, the angle of which is such as to strike evenly upon the top of the percussion cap. After having done its work of communicating fire to the exploding charge within the shell, the nipple F is crushed or broken off in passing through the cap G, and the bolt A is carried by its momentum into and through the armour, and at the same time exploded therein. The shell B is crushed and dropped or thrown off with or before the cap G. The nipple F may be placed in any suitable position to effect the explosion of the shell at any period or degree of penetration. The operation of the solid shot only differs from that of the shell in its not exploding.

BELL'S IMPROVEMENTS IN ARMOUR-PLATING.

THIS invention, patented by Richard Bell, architect, Gracechurch-street, consists in securing to the iron frames or ribs double surface plates, that is, plates somewhat similar in form to ordinary rails for railways, the web or beam connecting the two surfaces being of a depth varying with the requirements of the ship; the inner surface of the plates is recessed so as to receive between every two plates an intermediate and smaller, but similarly shaped, double-surfaced and webbed strengthening plate. Between every two plates where they are brought together on the outer surface, a rib or filling-up piece of teak or other suitable material is fitted; and for the purpose of tightening all the plates an aperture is made through the web of all of them, and through this aperture, a bolt or bolts in a heated state is run vertically; a key is then passed through the bottom of the bolt, which on cooling tightens all the plates, and gives stability to the whole structure. The inner surface of the plates is bedded on tarred felt or other like suitable material. In some cases the vertical tie bolt may be surrounded with a wooden washer or collar.

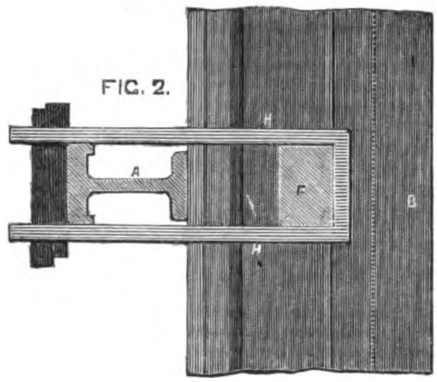
Fig. 1 of the accompanying drawings is a

FIG. 1.



section of a portion of a ship's side, armour-plated or protected according to this invention; fig. 2 is a section through the line *a*, *b*, of fig. 1. The patentee secures to the iron frames or ribs A of the ship plates B, somewhat similar in form

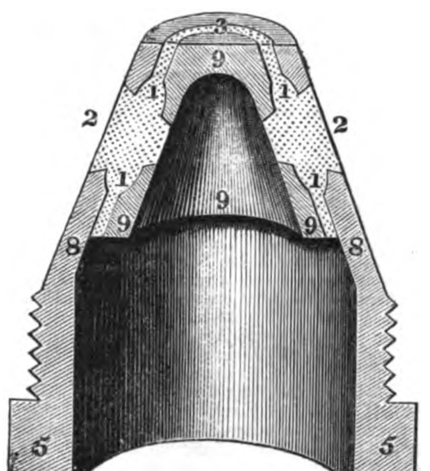
FIG. 2.



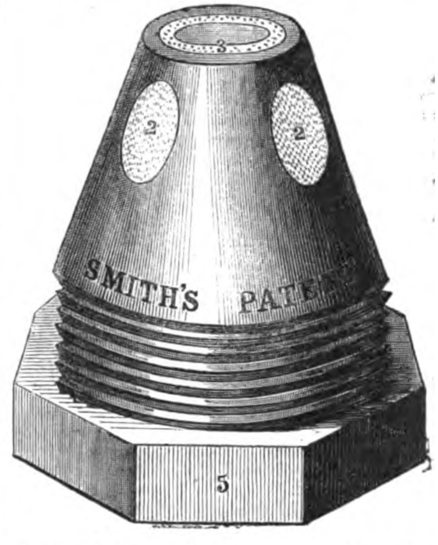
to ordinary rails for railways, the web or beam C, being of a depth varying with the requirements of the ship. The inner surface of these plates is recessed, as shown, to receive between every two plates an intermediate and similarly shaped strengthening plate D. Between every two of the plates B, where they are brought together on the outer surface, is fitted the rib or filling-up piece E, of teak or other suitable material, securing all the plates. Iron collars or clips H are placed at intervals round the bolts F, and keyed to the inner side of the frames or ribs A.

JOHN SMITH'S FUSIBLE PLUGS.

THIS invention consists in forming the body of the plug (which has usually been made in one piece screwed direct into the crown of the boiler furnace) in two parts, so that the one part containing the plug may at any time be removed without disturbing the part which is screwed into the boiler. In some cases, these plugs are



inserted or fixed entirely from the inside of the fire box or flue without the necessity of entering the boiler for the purpose. The patentee forms that part of the plug which is intended to be blown out by the fusion of the soft-holding metal, and the hole in which it is placed, in such manner as to present a greatly increased resistance to the blowing out of the plug by pressure alone. This is effected either by cutting grooves or screw threads in the hole, and similar grooves or threads in or upon the blow-out piece, and running the fusible metal between, so that the whole depth of the fusible must be sheared for pressure alone to have the effect referred to. Otherwise, instead of turning grooves in, or screwing the two parts, as described, the patentee forms each of them with a recess, so that the two, when placed together, will form a cavity in which the fusible metal may be run and which will effect a similar object. In the accompanying drawings—1 shows fusible metal between the external and internal cones; 2, fusible metal filling up the perforations of both cones; 3, ditto, shown



at the top between the two cones; 4, two-inch gas thread, fitting into boiler-plate beneath the water. This plug is, perhaps, the best of its kind, and is getting into extended use.

TRIAL OF STEAM FIRE-ENGINES.

AT the half-yearly inspection of Mr. Hodges' Fire Brigade, which took place at Lambeth, on Thursday week, some experiments with Messrs. Merryweather and Field's steam fire-engines, "Torrent" and "Sutherland," were undertaken; the most interesting feature being a trial of the time required to fill a tank holding 448 gallons. Steam was got up first in the "Torrent." The fire was laid in the ordinary manner, without any attempt at providing for a racing trial; the wood, consisting mostly of green cask hoops, far from dry. The match was applied at 41 minutes past 2 o'clock. The gauge moved in six minutes, and the times and pressures were as as follows:—In 7½ min. the gauge showed 5 lbs.; in 8¼ min., 10 lbs.; in 8 min. 35 sec., 15 lbs.; in 9 min. 3 sec., 20 lbs.; in 9 min. 35 sec. 25 lbs.; in 9 min. 40 sec., 30 lbs.; in 9 min. 50 sec., 35 lbs.; in 10 min., 40 lbs.; in 10 min. 12 sec., 45 lbs., at which pressure the engine started, throwing a very fine jet to varying distances and heights. A 1¼-in. nozzle was then fitted to the end of a long tank, capable of holding 448 gallons, which the engine filled in 2 min. 5 sec., under an average head of about 14 in.

Steam was then raised in the "Sutherland." This engine has been purchased by the Admiralty for the use of Devonport Dockyard. The match was applied at 3.30, and the first steam obtained in 3 min. 45 sec.; 5 lbs. in 4 min. 45 sec; 20 lbs. in 6 min. 20 sec.; 40 lbs. in 7 min. 45 sec.; and 80 lbs. in 8 min. 45 sec., at which pressure the engine started, throwing 1¼-inch jet to a height of about 150 ft. with great steadiness, the pressure in the boiler being 95 lbs., and in the air-vessel 80 lbs. Subsequently, four 1-in. jets were fitted to the hose, and with a pressure in the boiler of 115 lbs., and in the air-vessel of 50 lbs., some splendid work was done. Great trouble was experienced through the trials from the continued bursting of the leather hose pipes. A horizontal jet was thrown through a 1¾ in. nozzle to a great distance.

The 448-gallon tank was then filled, in 47 seconds, through a 1¼-in. nozzle, under a pressure of 100 lbs. in the air-vessel, and 115 lbs. in the boiler, steadily maintained. Steam was kept in both the engines with great ease, and more moderate firing than we expected, with the Crystal Palace reminiscences fresh in our memory.

TRIAL TRIP OF THE TWIN-SCREW STEAMER "CERES."

The first trial trip of the new twin-screw steamer "Ceres," built by Messrs. Dudgeon, of Blackwall, took place on Tuesday last; the vessel running from Tilbury to some distance below the Mouse Light and back. The following are some of the principal dimensions of the ship and engines:—The length of the ship is 176 ft., beam 21 ft., depth 13 ft. 6 in., burthen 500 tons. She is fitted with independent double-cylinder engines, cylinders 26 in. diameter and 21 in. stroke. Nominal collective horse-power 120. The average speed attained was 14½ knots per hour.

On the return to Tilbury, some experiments on her powers of manœuvring were gone through, with the following results:—First—helm a-port, port engine ahead, starboard astern—revolved on her centre in 2 min. 15 sec.; second—helm shifted and engines reversed—revolved opposite way on her centre in same time; third—whilst turning, the engines were suddenly stopped and reversed, and the counter-motion was instantaneous; fourth—starboard engine stopped, port going ahead, helm a-port—she performed the circle in 4 min.

Among those present were Admirals Sir E. Belcher, C.B., George Goldsmidt, C.B., John Duntze, and Captain Symonds, R.N., Messrs. Kitson, sen. and jun., and several other scientific gentlemen.

IRON FOR MOULDING.

In foundries where the castings are made of pig-iron, the qualities of which are well-known, the task of managing the cupola or melting furnace, and running the metal, is comparatively easy. But in foundries where cheap castings are produced and a variety of work manufactured, the management of the melting furnace is more difficult, and much practical skill is necessary to mix and heat the iron. In such foundries large quantities of cheap fusible scrap-iron, in the form of old pots, grate-bars, retorts, &c., are necessarily used. The qualities of such iron differ greatly. Some scraps are hard, others soft, and most of them contain much oxide and impurities. Old gas retorts are almost as difficult to fuse as wrought iron, and they generally require to be mixed with some iron that melts easily and flows freely. Some kinds of scrap-iron require a flux to unite with the oxide and impurities. Oyster shells are usually employed for this purpose. They are chiefly composed of lime, and by uniting with the impurities they form a black slag, which floats upon the surface of the molten metal, and has to be removed by an iron rod, which is stirred into the ladle, the slag adhering to it like glass to the iron rod of a glass-blower. A very intense heat is also required to fuse certain kinds of scrap-iron, and much care must be exercised in selecting coal of the proper quality for this purpose. The graphine or hard carbon which forms in the interior of iron gas retorts, is the best known substance from which to obtain an enduring heat of high intensity in a cupola. For melting some fractious kinds of scrap-iron, some moulders would give double the price for a ton of graphine that they would for the same weight of anthracite. This substance has now ceased to be used, because it has ceased to be made, owing to the general substitution of clay for iron retorts. A suitable substitute for it would be a great benefit to many foundry establishments. Old scrap-iron is more commonly employed in some foundries in the vicinity of cities, because it can be obtained in large quantities in such situations. We received a communication lately from the proprietor of a foundry in a country village, who stated he had been unable to use scrap burnt iron, such as furnace bars, &c. Old furnace bars of locomotives are much prized by some of the moulders in the city, as they are generally made of good iron, and are not so much burnt as other grate bars. Burnt iron, as it is called, is difficult to melt; it requires a flux of oyster shells or lime, and an intense heat in the cupola. For fine castings, scrap iron cannot be used with safety, unless the scraps are of uniform quality and their character well-known. An experienced moulder is competent to form a very accurate opinion of the nature of iron, from an examination of its grain, but the most skilful admit that there are so many different kinds of iron, they are frequently puzzled, and make mistakes as to their fusibility and capacity of flowing into moulds.—*Scientific American.*

STEAM PLOUGHS AT WORCESTER.

Continued from page 687.

Before proceding to notice machinery on the moveable-engine system, I would add a word of caution respecting the employment of second-hand thrashing machines for steam tillage. A 7 or 8-horse engine, working at 45 lbs. pressure, is quite unable to perform the work ordinarily expected of a steam cultivator or plough. On land where 5½ in. deep ploughing (with a horse-plough) gave a fair draught for a pair of horses, Messrs. Morton and Harrison found the draught of Mr. Smith's 3-tined grubber, when taking 30 in. breadth at a time, 5 and 6 to 6½ in. deep, to be 12 up to 19 cwts.; and again, the draught of Messrs. Howard's 3-tined grubber, when taking 3 ft. breadth, 4 to 5½ to 6½ in. depth, was 12 up to 21 cwts. At a pace of 3½ miles per hour, these cwts. represent so many horse-power; far beyond the nominal horse-power of the aforesaid thrashing-engine. By driving from, say, a 3½ ft. sheave, instead of from the 5 ft. fly-wheel of the engine, the obtainable draught may be increased—of course at a corresponding sacrifice of pace in the implement and of the acreage done per day. But if the engine boiler be sound and strong, and the fire-box well strengthened with extra "stays," the engine may be safely worked up to 60 lbs. pressure, giving out proportionally more than her nominal power. Engines expressly made for steam cultivation are extra strong, capable of working up to double their nominal horse-power; and it is with these that expeditions and therefore cheap cultivating and ploughing are accomplished.

Coming now to moveable-engine forms of apparatus, I will first refer to that of Messrs. Coleman and Sons, of Chelmsford. The engine travels at intervals along one headland, always opposite the end of the work; and from two coiling drums upon a longitudinal axis at the side of the boiler (and unavoidably of too small a diameter for the best usage of the rope), two ropes are led side by side across the field to two separate and independent implements. These are 5-tined cultivators, with tines that can be instantly set in or out of the ground. Each implement in turn is alternately hauled in work towards the engine, and then pulled backwards out of work to its next starting point; but each traverses only half the length of the field, one beginning where the other finishes its furrow, midway between the engine and an anchored pulley on the far headland. This arrangement (proposed by myself before the Society of Arts in 1858) enables the use of only a very slight anchorage, and a light rope around it, extending the length of the field, and connecting the two implements together; seeing that the working strain is only exerted directly between the implements and the engine. This thin rope is taken up or let out for varying lengths of furrow, by a drum upon one of the implements; and a self-acting brake upon the engine preserves the tightness of all the ropes, necessary for holding them off the land upon the rope-porters. Owing to the implements being single instead of double, they occupy less room and leave narrower headlands; working up to the engine, they can dispense with signalling; and there being neither windlass nor travelling anchorage, the whole tackle is removed from field to field by the locomotive engine, and set to work in a very short space of time. The grubbers make good work, and purchasers of the apparatus speak highly of its performances; but the system has not at present been adapted to turn-over ploughing.

Mr. John Fowler, of 28, Cornhill, and of the Steam-Plough Works, Leeds, has three distinct forms of steam-cultivating machinery; all based, however, upon the use of the moveable engine. In the simplest, an endless wire-rope is distended between a "clip-drum" under the boiler of a locomotive engine on one headland, and a pulley upon a self-travelling anchorage upon the other headland. The groove of the drum, being made of nipping pieces in pairs, pinches the half-turn of rope in exact proportion to the strain or draught, and may be set at pleasure to any degree of pressure; so that the rope is held without slipping in the grip of a 10, 12, or 14-horse engine, working up to double its nominal power. But though there is considerable wear of the clipping-pieces (which are very easily and cheaply renewed), it does not appear from experience that the rope itself suffers any more than it would from careful coiling upon a winding-drum. By means of a "taking-up" or "slack" gear upon the implement, the pulling rope employs about one-sixth part of its strain in maintaining a considerable degree of tension in the back or return rope; and by this self-acting contrivance, the entire length of rope is held up clear off the ground, riding over the friction-rollers of the rope-porters. The economy of motive power thus obtained is so great, that only trifling improvements in this direction remain possible to future inventors. It has been shown from Messrs. Morton and Harrison's experiments, that, out of a total draught of 23½ cwts. due to the work (with a 350 yds. furrow), 1 cwt. is consumed in moving the rope and pulley, and ⅓ of a cwt. more in moving the anchorage forward; leaving no less than 27 and 1-6th cwts. (or 95 per cent. of the total draught at the clip-drum) engaged in hauling the implement. And, deducting the average draught of the plough when out of work—2⅓ cwts.—the result is that 24½ cwts. (86 per cent. of the total draught) are actually applied to the severing and upturning of the soil. And considering further how largely the peculiar sources of friction and cohesion in horse-drawn implements are avoided in the steam plough and steam grubber (so that only minor improvements can be made either in the implement or the hauling apparatus), we see that little room can possibly remain for some novel machine which theorizers are expecting will one day accomplish two or three times as much tillage by the same expenditure of power. Saving of labour, too, can hardly be an important item in any future invention; seeing that to work this apparatus of Mr. Fowler requires only an engine-driver and ploughman, one anchor-lad, and a couple of porter-boys; of course, with the addition of cartage of fuel and water.

To accommodate customers who prefer a lower-priced machine, at the sacrifice of having to remove the engine, separate windlass, anchorage, &c., by horses, Mr. Fowler places a clip-drum with the requisite toothed-wheels and a driving-rigger, in a self-travelling carriage-frame, which has cutting flanges attached to its wheels to prevent sidelong slipping in the direction of the ropes, these flanges being removed when shifting from field to field. A common portable 8 or 10-horse engine, temporarily attached to this drum-carriage by a sort of iron shafts, follows it along the headland; a V-grooved rigger on the crank-shaft driving a similar rigger on the drum-carriage by means of a peculiar endless chain. This chain is composed of hard-wood blocks, wedge-shaped to fit the V-groove, and connected together by iron link-pieces. It conveys the whole force of a powerful engine, without slipping, no matter how loosely the chain may hang, and with large allowance for different angles of position of the two riggers; and the wear is probably very trifling indeed.

A third set of Mr. Fowler's machinery consists of two locomotive engines, one on each headland, hauling the implement to and fro, by means of a single length of rope, alternately wound and unwound by ordinary coiling drums, one beneath the boiler of each engine. A beautifully ingenious and very simple contrivance (in which is employed a travelling pinion gearing with two differential spur-wheels, demanding diagrams for an explanation) regulates the wrapping of the coils; but winding upon a drum with vertical axis can never be so neatly done as upon a drum with horizontal axis, in which case the coils are not liable to drop over one another when loose. As the rope can feed on to the drums at any angle of direction, and the engines (following any irregular line of hedge-row) take up or let out rope for varying lengths of furrow, without any hindrance or any attention on the part of the men; and, moreover, as there is neither windlass nor anchorage of any sort to be shifted or set down (so that after finishing a field, the engines can move off at once with rope and implement, and without the assistance of any horse at all, instantly commence work in another field), this double engine arrangement is admirably calculated for districts of irregular-shaped inclosures, and especially for working on hire. Of course, the slack half of the rope is only imperfectly carried; but then, all the rope out at once is only of the same length as the furrow. In economy of performance, unless the number of removals be excessive (as in contract work), the double-engine system falls behind that of the single-engine and anchor-

go; and it is, at the same time, a far more heavy investment.

I need not describe Mr. Fowler's implement. The 3-furrow or 4-furrow plough, balanced upon a pair of large-sized wheels, can be fitted up with cultivating-tines, or the plough-share can be used with short prong mouldboards (or "digging breasts"), which perform much more effectual tillage than any other cultivating-tines whatever. Trench ploughs, subsoilers, or double-breasted ridge-ploughs, may all be used on this implement. Another implement is the 5-tined or 7-tined cultivator, similarly balanced upon a pair of wheels, the tracks of which are obliterated by the tines following them. Another is a cultivator and subsoiler combined, working to a depth of 18 in. Another is a set of heavy harrows, hung in a light framing, to which the steering and slack-rope gear are attached. For working behind the plough, a 3 or 4-furrow land presser is provided, with seed-box attached; and a corn-drill is also supplied, to be worked alongside the cultivator, thus making a seed-bed and sowing at one operation.

The double-engine system is carried out in a novel manner by Messrs. W. Savory and Son, of Gloucester. A shell drum, of 6 ft. diameter, without arms or spokes, incloses the body of an engine-boiler,—revolving upon three pairs of friction-wheels, which are supported in brackets upon the boiler. The cylinders are placed transversely across the end of the smoke-box, over the steerage wheels; and the long crank-shaft passing inside the drum drives it by pinion and internal gear, and also by means of a screw or worm gives motion (at pleasure) to the hind* carriage-wheel axle. The drum will contain 500 yards' length of rope in a single layer of coils; and a couple of guide-rollers traversing the length of the drum by means of a rotating shaft, threaded like a screw, regulate the coiling so perfectly that the rope never overlaps itself; thus avoiding any grinding or damage from acute bending. Two engines thus fitted haul the implement (a Fowler's plough or Howard's grubber, &c.) to and fro from one headland to the other; the guide-rollers deflecting the rope when the furrow is not quite at right angles to the direction of the headland; while in case of an acute angle of direction, the engine can be moved forward and steered so as to present its broadside always toward the line of work. This setting of the engine askew may not be very advantageous to a moist headland; but there is plenty of time for the operation; one engine having nothing to do but to take up its position while the other is hauling the implement. To feed the boiler with water while the engine is at rest, Messrs. Savory employ a small "donkey-engine," placed (like the steering mechanism and reversing clutches) close at hand, under the command of the engine-man. Mr. Fowler's "double" engines supply themselves with water by simply running disconnected with their drum or propelling wheels. In Messrs. Savory's arrangement the cylinders are necessarily of short stroke, giving their full power only at a high number of revolutions per minute (unless at an excessive pressure of steam); and by driving the drum directly without reducing gear, too great a speed is obtained for any implement to work steadily. Travelling at a pace of more than 4 miles per hour (5 miles per hour in light work), the implement not only makes imperfect work, but incurs great risk of damage from land-fast impediments; and, besides, a broader cultivator, at a pace of 2½ to 3 miles per hour, would waste less time owing to the few number of bouts, each with its steady commencement and slackening of speed toward the close of the journey. The facilities of the twin-engine principle are well illustrated by this set of apparatus, which, without the assistance of any horse, brought itself along 30 miles of up-and-down-hill road from Gloucester in one day, and shifted from field to field, losing but a few minutes in gathering up or leading-out rope and taking up position ready for work.

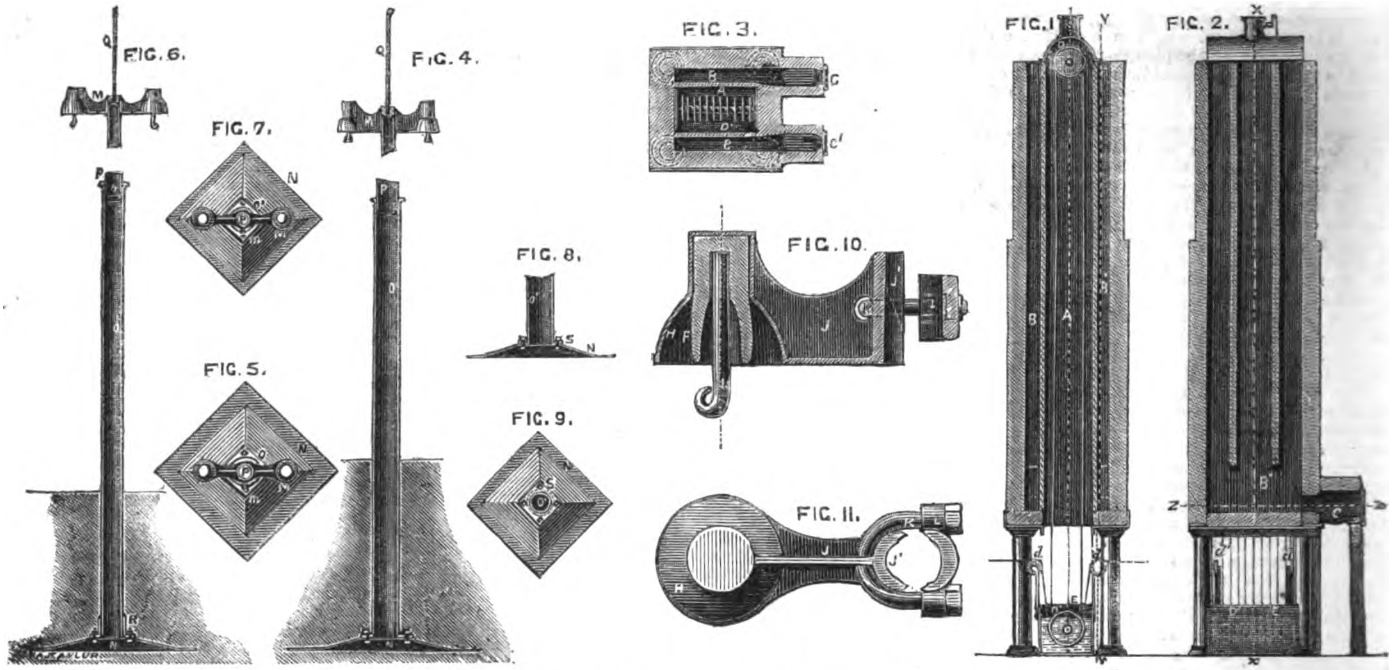
One more invention remains for notice. Mr. Collinson Hall, of Navestock, Romford, Essex, substitutes for wire-rope a chain, formed of ½-inch round steel rods, 18 in. long, coupled together by pairs of flat plates 4 in. long, with connecting rivets; and an endless chain, thus made, passes one half-turn round a pulley upon a self-travelling anchorage at the further end of the field. But the drum and pulley are polygonal instead of circular; and the link-chain is hauled by means of cog-teeth upon the drum taking into the apertures provided by the coupling-plates of the chain. The breaking strain of the plates (the weakest point) has been found to be about 14 up to 22 tons; the chain being probably stronger than wire-rope of equal weight. bility. The rods and plates of this link-chain (exhibited by Messrs. Turner, of Ipswich) present but little appearance of attrition after having ploughed 400 acres; and it is affirmed that not one rivet has yet been broken. The wear must take place chiefly on the ends of the rivets and in the eyes in which they work; but if the rivets be purposely made of softer metal, they alone will wear away, and the whole of the 2,800 rivets in 800 yards' length of chain may be replaced for some 30s. As the chain (from its sidelong rigidity) will not wrap upon a drum, it is unadapted to the stationary-windlass system, where greater economy of rope is most of all desirable; and, moreover, this necessitates a tedious unbolting and folding of sections of the link-chain for removal in a cart, instead of quickly and conveniently coiling it upon the engine-drum. Again, the chain cannot ride upon porters, owing to the excessive amount of play or hinge-action so demanded of the rivet-and-plate joints; hence incurring a very considerable waste of motive power. The comparative draught of a given length of this link-chain and of wire-rope trailing upon the ground has not been ascertained; but the weight of the present link-chain is 3 lb. per lineal yard, or from one-half up to twice more than that of the wire-rope of different sets of apparatus. Of course, it is a mere sophism to excuse the heavy drag of a rope or chain along the ground by saying that a cwt. or so more coal per day will give the extra power required; for when an engine is already working up to her full power compatibly with safety, an additional one, two, or three horse-power can be obtained only through a stronger boiler, a larger cylinder, and, in fact, by an entire engine of bigger dimensions and higher prime cost.

As applied to the twin-engine system, Mr. Hall's traction-medium deserves consideration. Instead of two 12 or 14-horse engines, each idle in turn while the other is hauling a single length of rope, he employs two 6 or 7-horse engines, both simultaneously hauling an endless link-chain and thus accomplishing as much work as engines of double the power, weight, and first cost. The back or return ply of the chain being always tight, can be mounted upon low porters; and the other ply along the track of the plough may be similarly upheld where in advance of the implement, though left upon the land where running slack. For varying lengths of furrow, a portion of spare chain is carried folded upon the implement; a hook that will lay hold of the chain at any point allowing one or more links to be left out or taken up at pleasure. I do not know why Mr. Fowler's twin-engines should not be of lower power, and work an endless wire-rope with clip-drums; thereby lightening the apparatus for a deep and sticky district, as well as sparing the contract proprietor or company several hundred pounds of purchase-money. The objection to two engines working at once is the difficulty of securing simultaneously starting and stopping; it remains to be seen how far this may be overcome,—perhaps by signal rope laid out between one engine and the other.

My account of the steam-tilling machinery at Worcester being intended to touch only upon points not fully elaborated in the Judges' Report, I leave all details of the four days' competitive field-work, merely drawing certain inferences, either from my own personal observation or from the official statistics and remarks. Comparing self-locomotive apparatus for that working a common portable engine, it appeared (in course of the trials) that the latter (if cultivating at the rate of about an acre per hour in moderate-sized inclosures) would lose more than two hours every other day in removing to fresh ground half a mile off, if 4 horses were employed for the operation; or it would require 8 horses in order to shift it about one to one and a-half hours. On the other hand, a couple of self-travelling engines would move the same distance in 25 minutes, without any horse at all; while a single locomotive engine with an anchorage would take a longer time than this, but equally dispense with the assistence of horse-flesh. Comparing the amount of labour required, we find the stationary-engine apparatus to be manned as follows:—Mr. Smith's, 6 men; Messrs. Howard's, 5 men and 2 boys; and Mr. Hayes', 4 men and two boys. The moveable engine employs hands as follows:—Mr. Fowler's separate-drum tackle, 3 men and 3 boys; Mr. Fowler's other tackle, 2 men and 3 boys; Messrs. Coleman's apparatus, 5 men and 2 boys. Mr. Fowler's, like Messrs. Savory's twin-engine plan, is worked by 2 men and 3 boys. In all cases, the labour of water-carting is additional. As regards the relative cost per acre of a given operation, I consider that no accurate test was furnished by indurated ground torn up into pieces of all sizes, and at average depths which, after the most careful measuring in a few spots, must remain open to differing individual opinions. Mr. Fowler's moveable 10-horse engine, and Messrs. Howard's stationary 10-horse engine, completed their equal plots (of less than two acres) in very nearly the same time, with about equal consumption of fuel; but the former worked five tines at once, and the latter only three. Mr. Smith's stationary 10-horse engine, with a 3-tined cultivator, working at the same depth as the other two, and making the most efficient tillage, burned somewhat more coal, and occupied one-half more time. Messrs. Savory's two 10-horse engines finished their plot in rather less time than either Messrs. Fowler or Howard's machines, but with nearly two-thirds more coal. In turnover-ploughing 1¼ acres each, Messrs. Savory, Fowler, and Howard, occupied nearly equal times. In cultivating a little over 1½ acres each at Wadborough, Mr. Smith's 10-horse tackle consumed the least coal, but took the longest time; Mr. Fowler's 14-horse engine expended both the least time and smallest quantity of fuel; Messrs. Howard's 10-horse tackle consumed a trifle more coal, and was considerably longer in doing the work; and Messrs. Savory's two 10-horse engines, while taking less time than Messrs. Howard's, burnt considerably more fuel. But the unavoidable absence of reliable dynamometrical tests, and the impossibility of assigning any exact value to the several degrees of effectiveness in the different works, forbid any minute deduction from these experiments as to the comparative economy of the competing machines. Mr. Fowler's two 12-horse engines, for instance, consumed as much coal as Messrs. Savory's, and spent more time than Messrs. Howard's—nearly as much as Mr. Smith's—in tilling about 1½ acres; but then their work done by the digging-breasts was very superior to any other in the field. It may be taken as a general conclusion that a moveable engine—working with less rope, fewer pulleys, and consequently less waste of motive power, while employing fewer workmen—performs any given process at less cost per acre than a stationary engine can; and this point together with the very low expense of all the steam-tillage done, is illustrated in the Judges' Report, where the percentage for interest and wear and tear is by no means too favourably assessed. But the reader should bear in mind that while Mr. Fowler's work with a moveable engine cost less money per acre than the work of either Mr. Smith's or Messrs. Howard's stationary engine, the difference in his favour would have been greater had the areas in the competitions been, say, 20 acres each, instead of only some 2 acres each; seeing that the additional length of rope required by the round-about system becomes a serious drawback when surrounding a large enclosure, and not perfectly carried off the ground.

At the the Worcester trials hard stiff loam was cultivated 7 in. deep by Mr. Fowler's 10-horse-power machine at the rate of 9¼ acres per day, and a total expense (without removals) of 4s. 9d. per acre; and Messrs. Howard's 10-horse-power machine worked at the rate of half an acre per day less, and 2d. per acre more money. Ploughing 6¼ in. deep, with the same set of hauling apparatus, was performed by Mr. Fowler at the rate of 7¼ acres per day, and a cost of 6s. 3d. per acre; and by Messrs Howard, at the rate of 7 acres per day, and at 6s. 4d. per acre. But by way of contrasting steam-power performance with that of horses, I must cite one or two of the most memorable feats in the moister and more suitable fields at Leeds and Canterbury. At the latter trial, in 1860, in ploughing a strong loam (which from the ascertained draught of a common plough at 6 cwts., would cost 12s. an acre if turned over by horses), Mr. Fowler's 12-horse engine, working with a pressure of 68 lbs. on the square inch, drove 4 "3 horse-furrows" at once at the rate of 11 acres in ten hours; and the total cost was computed at 4s. 6d. per acre, in stead of 12s. (the lowest price by horse-labour), though the excessive allowance of 20 per cent. was put down for interest and wear and tear. At Leeds, in 1861, Messrs. Howard's 10-horse engine scarified a strong and stubborn soil 5 or 6 in. deep, at the rate of 6¾ acres in ten hours, at a cost of 6s. 8d. per acre. Mr. Fowler's 12-horse engine scarified the same soil 7 in. deep, at the rate of 5¼ acres in ten hours, at a total cost of 7s. 2d. per acre. In land where the ploughing of a single furrow 8 in. deep required a draught equivalent to the power of 5 horses, the same engine ploughed at that depth at the rate of 5¾ acres in ten hours, for a total cost of 7s. 10d. per acre. Of course in reading these figures (as well as those of the Worcester Judges' Report) it should be borne in mind that, though ordinary wages are charged for the labour, the trained hands of exhibitors are masters of larger daily acreage than could be expected from common farm workmen.

SIEMEN'S TELEGRAPH WIRES.



SIEMEN'S IMPROVEMENTS IN SUPPORTING TELEGRAPH WIRES.

This invention, patented by Mr. C. W. Siemens, of 3, Great George-street, Westminster, consists of improvements in insulating and supporting telegraph line wires. Telegraph line wire is sometimes covered throughout its length with an insulating material, and at other times is suspended in the air from poles with insulating supports for the wire attached to the same; in the latter case, the atmospheric air is the insulating medium surrounding the conductor.

In forming a continuous insulating covering upon a conducting wire, the patentee employs the juice or milk extracted from the india-rubber or gutta-percha trees, or varieties of the same. For this purpose, metallic or other vessels capable of being hermetically sealed are sent out to the countries where the trees abound; these vessels being attached to the tree receive the juice through a connecting tube, as far as is practicable under exclusion from contact with the surrounding air. These vessels, when filled with juice, are hermetically closed by means of a screw-stopper or otherwise, and are then shipped to this country.

In effecting insulating coverings by means of these juices, which will be found to remain entirely liquid in the sealed vessels, the patentee proceeds in the following manner:—The naked wire or strand of wires is first covered with a layer of silk, cotton, or other fibrous material in the usual way; the wire thus covered is passed through or soaked in a bath of the juice, and drawn up through an air flue or shaft of considerable height, which is maintained at a temperature of from 100 deg. to 300 deg. Fahr., either by the external application of heat, or by a continuous supply of heated air from a stove. An arrangement for this purpose is shown at figs. 1 to 3 on the accompanying drawing.

Fig. 1 shows a transverse section of the same on line X, X, fig. 2; fig. 2 shows a longitudinal section on line Y,Y, fig. 1; fig. 3 shows a sectional plan on line Z, Z, fig. 2. The same letters of reference indicate the same parts in each of the figures.

A is a broad brick shaft with the hot-air flues B, B_1, on each side; C, C_1, are two stoves for heating the same; a series of pulleys D is placed on an axle at the top of the shaft, and a second series D^1 is so arranged at the bottom that the pulleys can be submerged in a bath E, containing the juice of the india-rubber or gutta-percha tree, or each pulley may be placed in a separate bath. The wire is led into the shaft over the guide pulley *d*, and dips immediately into the bath E, by which it becomes covered with juice; it then rises up the shaft A, where, under the influence of the heated air, the film of juice adhering to the covering of the wire on leaving the bath becomes rapidly consolidated and dry. The wire is passed over one of the top pulleys and down again into the bath, by which it receives a second film of juice, which dries in the same way, as the wire again passes up the shaft, and so on, till the wire has got a sufficient number of coatings, when it passes away over the pulley d^1. Instead of one large bath of india-rubber juice or gutta-percha juice alone, these two substances may be mixed with advantage, or a number of small baths containing alternately gutta-percha and india rubber juice may be substituted, so that the wire would receive alternate coatings of these substances.

In suspending telegraph line wires in the air, an insulator is employed, consisting of an inverted bell of porcelain or hardened india rubber or ebonite, which is cemented into an inverted cup of cast iron to protect the same from rain and injury, which cup may be either painted, galvanized, or enamelled. A iron or steel stalk, the surface of which is either enamelled or covered with ebonite or hornified india rubber as far as it will be exposed to the atmosphere, is cemented into the inverted insulating cup and turned up at the lower end, or provided with other means for supporting or fixing the line wire. The cast-iron protecting cup is furnished with an arm terminating in a socket, the axis of which is parallel to that of the cup, and which is slipped over the post or main support; or in place of a socket, a curved flange is formed at the end of the arm, fitting partly round the post, against which it is firmly secured by means of a horseshoe strap passing over it and through an iron saddle on the opposite side of the post, where it is screwed up, as shown in section and plan at figs. 10 and 11, where F is the inverted bell of porcelain or hardened india rubber; H, the inverted cup of cast iron; I, the enamelled stalk; J, the arm; J^1, the flange to the same; K, the strap; and L, the saddle-piece.

Two such insulators may be formed on the same bracket to support a wire on each side of the post, as is shown at M in figs. 4 to 7. In this case, either a set screw *m* or a wedge may be employed for fastening or steadying the bracket on the post. The posts mostly hitherto employed have been of wood, and iron structures with or without wooden tops have also frequently been used. The wooden posts do not afford a durable support to the insulated wire, as they are subject to decay; and the iron posts hitherto employed are very costly and difficult to transport. In order to meet these difficulties, the patentee constructs telegraph posts of three parts, to be carried separately and put together on the spot. The part of the post which is buried in the ground is formed of a dished plate of wrought iron, combining lightness with rigidity in a remarkable degree. A cast-iron pipe is fixed by bolts to this foot plate at or near the middle, which pipe rises considerably above the ground line and terminates in a socket to receive the upper portion of the post, which consists of a conical tube of wrought iron welded together longitudinally, combining strength with lightness and compactness in a high degree. This tube is fastened in the socket by pouring in a cement, consisting by preference of sulphur with an admixture of oxide of zinc or other metallic oxide. The wrought-iron tube may be surmounted by a metallic rod for the discharge of atmospheric electricity into the ground. Both the lightning discharger and the stalk of one or more insulators may be dropped side by side into the top of the wrought iron conical tube, and be secured by a wedge or in any other suitable manner. Each of the three essential parts composing this post is of such moderate size and weight as to admit of convenient transport, which is of great importance in constructing telegraph lines through uncultivated countries.

Figs. 4 and 5 show a sectional elevation and a plan of this construction of telegraph posts. N is the dished plate; O is the cast-iron socket attached thereto, and P is the conical wrought-iron tube; Q is the lightning conductor formed with a loop at the top, through which a wire passes connecting all the posts with each other, so as to discharge simultaneously through all the posts.

Figs. 6 and 7 show a sectional elevation and a plan of certain modifications, in which, instead of bolting a dished or buckled plate of wrought iron immediately to the foot of the tube, it is bolted to the flange of a cylindrical cast-iron socket R, into which is cemented the lower end of a cylindrical wrought-iron tube O^1. Inside the latter, near the upper end, is rivetted an inverted iron cup *o*. The upper tube is conical and of wrought

SPENCER'S STEAM-ENGINES.

FIG. 1. FIG. 2.

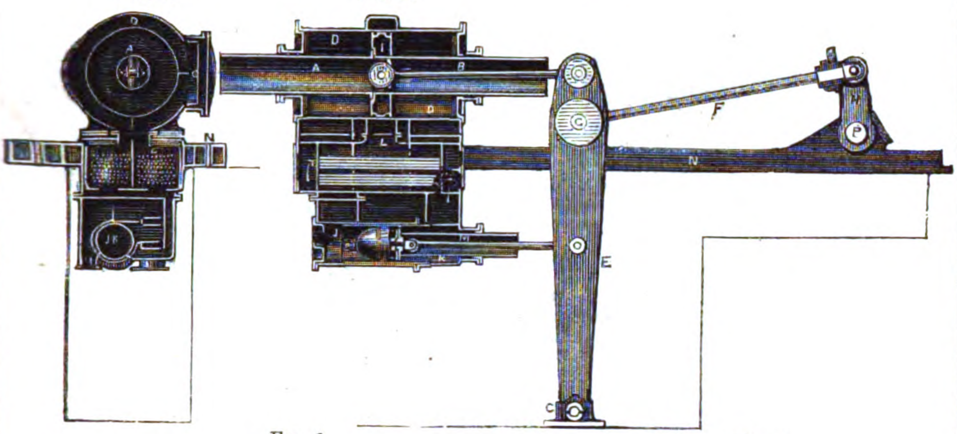
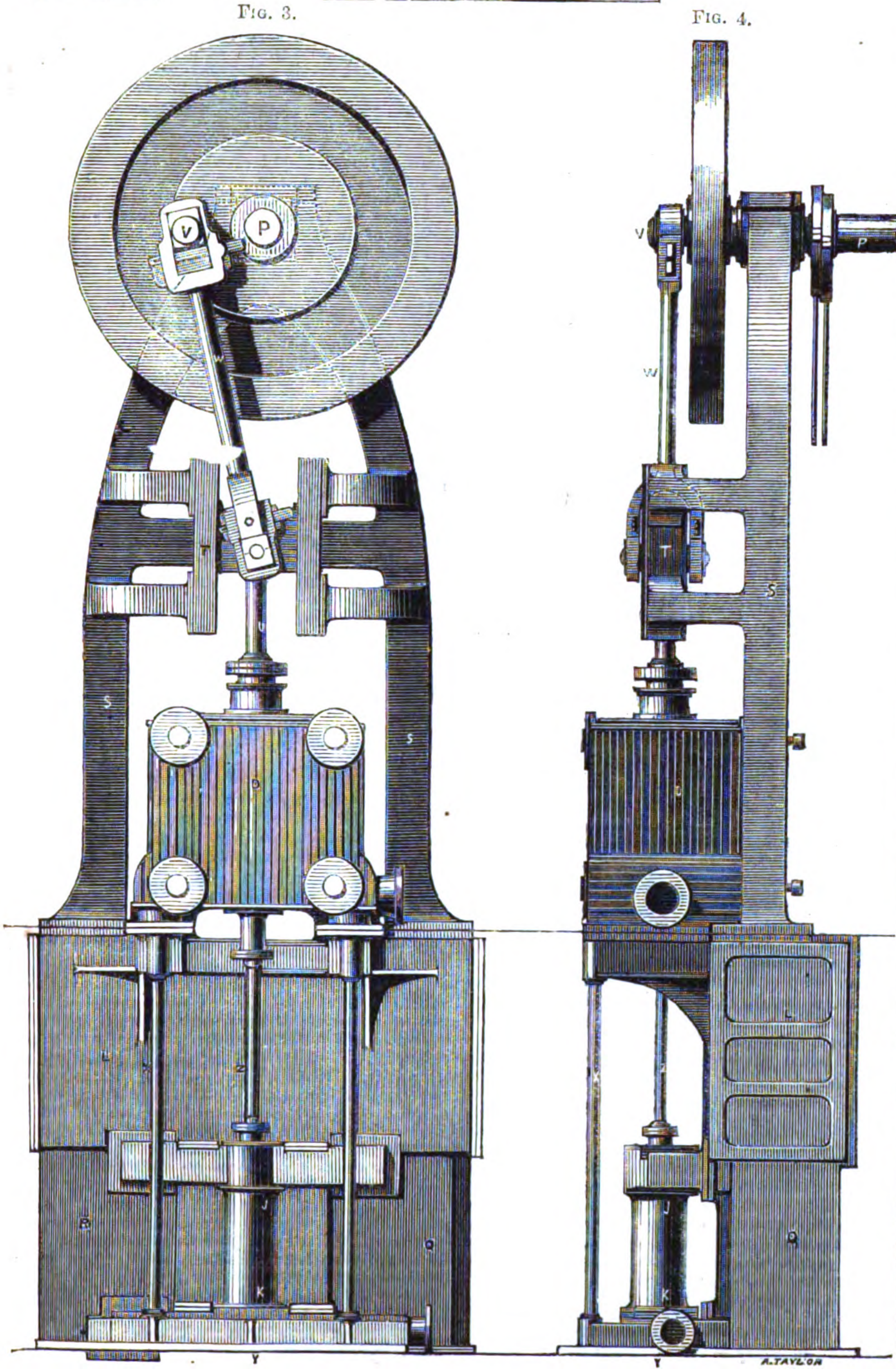


FIG. 3. FIG. 4.



iron; its lower end rests on the bottom of the iron cup *o*. A cast-iron collar or boss *p* is passed over the upper or conical tube, and pressed down, by hammering or otherwise, until it rests on the top edge of the lower tube. The joint is then completed by pouring fluid cement through a hole in the collar.

A second modification, shown in part sectional elevation and plan at figs. 8 and 9, consists in connecting the tube O¹ to the foot plate N, by means of a cast-iron collar S bolted on to the latter, the bottom of the wrought-iron tube being hammered outwards so as to form a flange upon which the collar presses.

SPENCER'S IMPROVEMENTS IN STEAM-ENGINES.

THE following improvements in steam-engines have been recently patented by John Frederick Spencer, of Newcastle-on-Tyne.

This invention relates to improvements in arranging and combining together the parts of steam-engines with surface condensers to suit particular requirements and situations.

One modification of the improved arrangements, which have reference to the convenient working of the air and cold-water pumps, is suitable where the crank shaft is required to be near the ground line, and where space can be afforded for a horizontal or inclined engine or engines. This modification is represented, so far as is necessary for convenient explanation, in figs. 1 and 2 of the accompanying drawings, these two figures being vertical sections taken at right angles to each other. In this plan, a hollow piston rod or trunk A is used, having jointed inside it a short connecting rod B jointed at its other end to a vertical lever E, working on a fulcrum C some distance below the level of the steam cylinder D. The main or usual connecting rod F is jointed to the vertical lever E at a point G below the joint of the connecting rod B; it may, however, be jointed to the vertical lever E at any convenient point above, below, or in the line of the cylinder D, the throw of the crank H being correspondingly greater than, less than, or equal to the stroke of the piston I. The lever E may consist of a single arm or plate, or of two or more arms or plates having the joints between the plates. Separate pumps for the air and for the cold water may be used, but it is preferable to employ a combined air and cold-water pump J, K, as shown, when there is only one steam cylinder D, the pump being placed horizontally beneath the steam cylinder D and condenser L, and being worked from the lever E by a rod jointed inside of the hollow piston rod or trunk M of the pump piston; the feed pump may also be disposed horizontally in any convenient position, and be worked in a similar way from the lever E. The surface condenser L is placed immediately under, and forms the support of the cylinder D; and it may be cast in one piece with, or be united to, the frame pieces N, having at the opposite end the bearing or bearings for the crank shaft P. The condenser L, with the side frame pieces N, is firmly bedded on and bolted to masonry or timber foundations, as may be required, and the air and cold-water pump J, K, is bolted to the under side of the condenser L. The condenser L is represented as arranged internally, according to the usual system, the tubes being placed horizontally and parallel to the axis of the steam cylinder D. The inner end K of the pump acts on the cold water, forcing it into a lower compartment between the inner tube plate and cover of the condenser L, from which compartment the water passes through the lower half of the tubes to the other end, returning again to the inner end through the upper half of the tubes. The back or outer end J of the pump acts on the water of condensation and the air, these reaching it from the condenser L by passages, the arrangement of which will be easily understood from the drawings. With these arrangements, both ends of the condenser are conveniently accessible for examining the tubes and the various passages, and other details can be got at with facility. A surface condenser of

any suitable known kind may be substituted for the one described.

When two steam cylinders are used, each may be combined with a separate surface condenser similarly to the arrangement described, or a single surface condenser may be placed between the two cylinders, and at a level sufficiently low for the exhaust ports to drain into it, and in this case the condenser shell bedded on and bolted to masonry or timber foundations, forms the support of the cylinders inside, whilst outside they are supported by masonry or timber, as required. If three or more steam cylinders are used, either the arrangement last hereinbefore described can be extended, or each cylinder may be provided with a separate condenser. When two or more steam cylinders are used, the air and cold-water pump or pumps may be attached to the condenser side or sides.

Another modification is suitable where it is required to have the crank shaft some considerable height above the ground or floor level, and the modification is represented as applied in the case of a single steam cylinder in figs. 3 and 4. In this case, the condenser L is placed partly or entirely under the ground level, and is supported below on two hollow-chambered legs Q, R, cast on or bolted to it—one leg Q forming the hot well, and the other R an air vessel for the cold-water pump. On the top of the condenser L there are placed a vertical steam cylinder D, and an arched or two-legged standard S, the latter carrying one of the bearings for the crank shaft P, and, having attached to it the piston rod, guides T, the piston rod U, and crank pin V, being connected together by the common connecting rod W. The steam cylinder D considerably overhangs the condenser L, its outer side being supported by columns or standards X resting on a sole plate Y. Below and on this sole plate Y are fixed, vertically, either separate air and cold-water pumps, or, as is preferred and shown in the drawings, a combined air and cold-water pump J, K, which is worked directly from the main steam piston by a rod Z passed through a stuffing box in the bottom or lower cover of the steam cylinder D. The valve chambers and passages in connection with the pump J, K, are arranged conveniently for access, as will be clearly understood from the drawings. If two steam cylinders are used, the second cylinder with vertical pump below it may be similarly arranged at the other side of the condenser, additional standards being provided, as required.

LIGHTING OF COAL PITS.

A NEW method of illuminating fiery collieries has been proposed by MM. Dumas and Benoit, and which they say, so far as their experiments have gone, gives promise of success. In effect, the method consists in supplying each pitman with a "Geyseler Tube," in place of a Davy lamp. The light within the tube, which is of fluorescent (uranium) glass, is produced from a Rhumkorff's coil placed at a distance from the face of the workings. Insulated wires lead from this to each of the illuminated tubes, which can as easily be moved about as a Davy lamp, except, we may remark, that there will be always dangling from each the pair of wires; and as the tubes are hermetically sealed and do not rise perceptibly in temperature, or as the inventors express it, "*la lumiere est froide*," so there is no possibility of ignition for the explosive gases. The light obtained, they admit, is feeble, but this they expect to improve upon.

A ruptured wire might, we submit, produce ignition at the instant of fracture, in this case; otherwise the apparatus is probably perfectly safe. We doubt its likelihood of success in a practical sense however; although we feel perfectly certain that sooner or later all coal pits and all mines will be illuminated by some form or other of electric light; and that the Davy lamp, beautiful and ingenious as its principle is, and with all the good service it has done, will come, before very many years shall have passed, to be deemed a thing of a comparatively barbarous and imperfect epoch of mining.—*Practical Mechanic's Journal.*

TESTING ARMOUR PLATES.

THE recent firing at 5½-inch armour plates on the side of the "Monarch" target ship at Portsmouth was attended with an unusual degree of interest, owing to the fact of its being the first time the four leading firms in England had supplied plates of equal thickness of metal for trial. We learn, from the *Times'* report, that they consisted of one each from Messrs. John Brown and Co., of Sheffield, the Mersey Iron and Steel Works, the Thames Iron Works and Shipbuilding Company, and the Millwall Company. All four were good plates, but with varying degrees of excellence. Messrs. John Brown and Co's. plate is the best of the four. Four shots struck this plate in a vertical line, but they opened no cracks in the same direction, nor otherwise, except in the indents. Two of these shots overlapped each other 3 in., but the result of the two blows only produced an indent of 2½ in. in depth—an unprecedently favourable result, as showing the excellent resisting power of the iron. Eight shots struck within 3 ft. of the left of the plate, and three of them on the very edge, but only produced the usual small cracks exhibited by this firm's plates within the circumference of the indents. No signs of concentric cracks are shown round the indentations of these edge blows. The Mersey plate received 13 shots in all, and stood very well for the "first" rolled plate produced by this firm. The metal has a soft appearance, and seemed of good quality; but there was a tendency in it to crack vertically—a fault which will, doubtless, be guarded against in future productions. The Millwall plate was not of so good a quality as the 5½-inch plates previously sent in for trial by the firm. The welding was very faulty. It received 11 shots. The Thames Company's plate was very severely injured by the 9 shots fired against it striking on the weakest points. Five struck in an area of 3 ft. by 18 in., and three of them joining in their circumference of indents. The effect, however, was only slight, though numerous cracks were made from the severe pounding the iron had received. The gun used was the ordinary 68-pounder, and cast-iron shot with 16 lbs. of powder, at 200 yards' range. On the day following the trial of the plates, a smooth-bore 100-pounder gun was shipped from the "Excellent" on board the "Foam" gunboat, and the latter vessel proceeded up the harbour, and took up a 200-yards' position from the target ship and the plates she had fired at with her 68-pounder on the previous day. A shot was fired at each plate with a 25 lb. charge of powder, and in all but one instance the damage inflicted appeared to be commensurate with the increased weight of the shot and size of the charges, as compared with the 68-pounder. A further careful inspection hardly confirms this belief. In all but one instance the plates had been damaged by previous firing from the 68-pounder, and no fair inference could therefore be drawn from the results. In the one instance referred to the Millwall plate was struck fairly in an uninjured part by the round 100-pound shot, and the result was—diameter of indent, 10 in.; depth of indent, 3 in. There were cracks across the centre of the indent. The average diameter of the indent from the blows of a 68-pounder is 9 in., with a depth of 2½ in. The "Monarch" is now having plates bolted on her sides for further experimental firing, including a trial plate for the "Research" from the Butterly Company, and one from the Thames Company for the "Minotaur."

NEW WORKS, RIVER WEAR.

AT the meeting on Wednesday week of the River Wear Commission at Newcastle-upon-Tyne, a report was read from the Executive Committee upon the proposed new works at the River Wear. The report recommended that the length of the new dock should be 420 ft., but that at present it should be made only 250 ft. long, and 60 ft. broad at the entrance, so as to allow overlapping of vessels. The site of the new dock was at the south-east corner of the north half-tide basin, and beyond the length of 420 ft., it would be necessary to construct a barrier to the sea. The next subject was that of reconstructing the north-east pier of the south harbour or outlet, on plans by Mr. Meik, with a view to give the outlet additional security. It would be a perfectly independent pier—independent of the present groyne pier, could be constructed with great ease, and completed for £13,000. Mr. Meik, the engineer, reported with respect to the outlet, that the new breakwater forming the west pier of the new harbour was close upon completion, and he anticipated from it most beneficial results to the scour of the channel and the protection of the dock gates, when the masonry of the breakwater was raised to its full height. It would give protection from the south easterly gales, while the proposed new north east pier would protect the harbour from north easterly gales. The effect of the new breakwater on the channel had been to increase the depth from 4½ ft. low water of ordinary spring tides, to an average of 9 ft.; and as the foundations of the pier gradually grew towards completion, it was observed that a little soft mud only, instead of sand, was deposited. He anticipated that now the scour would keep the channel quite clear, and the breakwater would act in stilling the waves, while the north east pier would protect the dock works. With respect to the graving dock, if they made it 250 ft. long at first, they could deposit the matter excavated seaward, which would form firm consolidated ground by the time they required the further extension of 420 ft. The work, if completed all at once, might be affected by the water. The plan has been approved, and the work will be proceeded with immediately,

THE BOLTS IN THE MONITOR TURRETS.

A PARAGRAPH in the *Scientific American*, called attention to the defective manner of fastening the plates in the monitor turrets, and suggested the hope that inventors would turn their attention to remedying the evil. In response to this call we have, says that paper, received many letters from different persons, all mentioning plans for preventing loss of life from the cause alluded to. Among some of these are the following:—The turret should be constructed of wire netting in several thicknesses, in all 8 in., or more, the whole to be well saturated with coal tar. It will be perceived that here bolts are needless, a most summary method of avoiding the trouble. Another plan suggested is to construct the bolts of a tapering form that they cannot be forced in by the shot; still another inventor says that by tapping the holes in the turret and screwing the bolts into them the danger will be obviated. A plan is also forwarded to us wherein india-rubber washers are placed under the bolt heads and iron shields over the nuts inside, said shields being secured to the turret body by tap bolts.

A correspondent, A. H. Fleury, of Philadelphia, directs our attention to a patent recently granted to Gervase B. Maurey, of Danville, Pa., for an improved plan of building up turrets, to avoid danger from the flying bolts, &c. The turrets are to consist of tongued and grooved bars, rivetted together in the centre, or inside of each bar, in such a manner as to make a continuous joining of all bars used in the work; they are laid lengthwise, or horizontally, and, as a consequence, present a smooth solid surface externally. The rivets running through them, perpendicularly, are placed 3in., more or less, according to the thickness of walls, from the surface. There can be no exposure of the rivets to shot or other projectile striking the side or surface of the vessel or fortification constructed of such bars. Mr. J. L. Jürgens proposes to build a turret of three different layers—one of wood and two of iron bars, standing in a vertical position, with cotton, india-rubber, or other elastic material interposed. The inner (wooden) strata to be stationary, the yielding to be increased outward, and the curved gullies in the cap and step, for said bars, to be increased proportionally, according to the yielding of the elastic material.

NOVEL CONVERTING PROCESS.

WE learn upon excellent authority (says the *Colliery Guardian*) that there is now being completed at Smethwick, near to Birmingham, an invention, which it is promised will be productive of the most important results in the manufacture of finished iron and steel. The statement is that some gentlemen, natives of Holland, have for a considerable period been occupied in perfecting machinery for converting molten iron into steel, somewhat after the method adopted by Mr. Bessemer, but it is alleged a greatly superior one. Some £3,000 or £4,000 is asserted to have been spent upon machinery and experiments by the inventors; and although all is not yet quite complete, still operations have so far progressed, that a company, it is understood, is about to be formed to bring the invention before the world. So far as the process is at present known, it is said to be carried on by the aid of machinery, the leading features of which are three vessels. In the first a description of gas is generated, the properties of which are known only to the inventors. This is passed into the second, which is a kind of crucible, and hermetically sealed. This crucible

has by that time been filled with pulverised cast iron, which is heated to a low temperature, at which certain vapours are given off that are taken up by the gas from the first vessel. Each has an affinity for the other, and both then pass in one stream from the bottom of the crucible, and it is conveyed into the third vessel, in which there is iron in a molten state. Here the effect of the combined gas upon the molten metal is such that in a brief time, and with scarcely any waste, the whole is converted into a very excellent quality of steel. Then, the powdered cast iron in the second crucible, after it has been used for the purpose named, is said to contain such intensely combustible properties that 1½ lbs. of it will give off as much heat as a ton of coal! further, the same material if introduced into the ordinary puddling furnace will, it is averred, so greatly facilitate the operation of puddling, that two tons of iron may, by its use, be made in the time now consumed in making one ton.

This is effected by the influence which the material exercises in hastening the "boiling" and in bringing to the surface the whole of the molten contents of the furnace, so that the carbon which is given off in the operation of puddling, may be taken up by the oxygen of the atmospere—a result the securing of which is the chief work of the puddlers. It require no remarks from us to convince every one that the invention, if only the half that is said of it be true, is one of the greatest importance, not alone to the makers of iron and steel, but to every consumer of those metals—and who is not a consumer?

HOW TO FORETELL THE DIRECTION OF THE WIND.

It is one of the general rules concerning the force and direction of the wind, that the wind will always be in an easterly direction when localities situated to the northward of some place of observation have a high reading of the barometer; and, on the contrary, the wind will be in a westerly direction when the reading of the barometer is higher in localities situated to the southward of the same place of observation. In the first instance, the wind, without exception, is between south-east and east-north-east, whereas the westerly direction is again almost without exception between south-west and north-west. If it so happens that at the same time there is a difference of the reading of the barometer between localities situated in an easterly and westerly direction from each other, the wind in the first case will partake more of the northerly, in the other case more of the southerly direction. The future direction of wind, therefore, may be determined by the following rule:—When one has the lowest reading of the barometer to one's left hand, the back is turned to the region whence the wind will blow. As for hurricanes, one has always towards one's left hand that locality where the wind will blow most vehemently; regard being, however, taken to the direction of the wind. The reading of the barometer in places towards the south from us is on the average higher, since westerly winds predominate; but as westerly winds are on an average more violent than easterly, one may pretty safely infer that an ordinary difference north above south is less to be apprehended than an equally large difference of south above north. When the barometer reads higher in the north than in the south, the force of the wind is certainly as much greater as the difference of the readings of the barometer is greater; it may even be as large as six millimetres, without there being any just apprehension of a gale of wind. The greater the difference, the more sure one may be that the wind will turn towards the east, and keep to that quarter for some days. It only occurs once in a hundred times that during the blowing of a westerly wind the barometer reads a couple of millimetres higher in the more northerly places; such occurrence invariably indicates a great disturbance of the atmospheric equilibrium; and a heavy fall of the barometer in the north, or a rise in the south, commonly even ensues the very same day; while even on that day, or a day or so later, a gale of wind from the westward begins to blow. When, on the contrary, the south reads four or more millimetres above the north, one ought to be on one's guard. If the reading of the north is above that of the south, and an easterly wind does not then quickly succeed, that rise of the barometer must not be considered as being due to a regular division of pressure of the atmosphere, but only to the temporary abiding of an atmospheric wave, and a strong westerly wind may be expected next day. According to accurate observations, we find that 40 times in 118 a gale of wind will ensue when the south reads higher, and I repeat, therefore, here what was already observed before—a gale of wind is always announced, but with the announcement the gale does not always follow. A danger known before it is really present ceases to be so, or at least loses a good deal of its power; and whether the gale does occur or not, one has been warned, and can be guarded. Science incessantly proceeds, and the day is not, perhaps, very far distant when in this department also very important truths will be brought to light. I ought not to neglect to observe that the gale does not always break out within the first twenty-four hours; the difference in the readings of the barometers is often again the same on the next and even on the third day; but the wind becomes heavier and heavier, and at last a violent gale breaks out. A ship, therefore, having left port on the first day, would not have fallen in with the gale of wind on that day, but only on the next ensuing. The repeated warnings are to be considered as *one*, which renders the whole more important.—*Chemical News.*

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—A. J.—G. S.—J. N.—W. R.—S. S.—J. K.—G. W.—J. W.

N. M.—The examination is not very severe; specimens of your abilities as a draughtsman will of course be required. A moderate knowledge of engineering, the principles of construction, mathematics, and arithmetic, are indispensable. You will need some interest.

SAFETY.—The application of electricity to signalling on railways is by no means new, and we have failed to discover anything very original in your design. The simple cord as used on the Great Eastern and some other lines supplies every requirement.

P. T. (Bradford).—If the load is quiescent, a 1-in. rod is sufficient to sustain 5 tons.

Z. Y. (Newcastle).—Your injector has failed simply because the tank is too far below it. With such small instruments as those numbered 3 and 4, the tank should always be placed a foot or so above the injector.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

BOILER EXPLOSIONS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Mr. Colburn having failed, in his note last week, to deal with my letter of a fortnight ago, except in one point, allow me to reply that the discussion on the explosion on board the "Great Eastern" took place on Monday or Tuesday, the 12th or 13th September, 1859, which was *before* the publication of the first article on that subject in the *Engineer* of the 16th following; and not *after*, as he, for the first time, suggests; whereas, in the whole course of his correspondence with me, until now, he has never questioned the actual sequence of events, though they have been occasionally adverted to and recognized therein.

My explanation of the phenomena of the explosion, *then*, was the same as it is *now*, the same as I have frequently made in that correspondence, and the same as I made in the *Encyclopædia Britannica*. He alleges that he did not understand it, that he now understands it, and that he dissents from it; nevertheless, it affords, I believe, a plain and instructive illustration of my projectile theory.

That he either did not understand my explanation, or dissented from it at the time, is proved by his first leader on the subject in the *Engineer* of the 16th September, 1859. "The casing," he then said, "must, up to the moment of collapse, have been full of water." "The first incident of failure having been a collapse [in which he agreed with me], and as soon as the pressure upon the 11 tons of water was removed, this was, to a great extent, instantaneously converted into steam, and, with an energy sufficient to complete the catastrophe, by exploding the outer casing." And, in the *Engineer* of September 23, 1859, he adds, "The contained heat of the water would instantaneously convert a considerable portion, *if not all of it*, into steam, and with such suddenness as immediately to render apart the outer casing"!! Note—first scientific blunder—*all* the heated water "flashed into steam," 11 tons of it; whereas only 154 lbs. weight, or 1-160th part of it could have "flashed" into steam before the explosion; second—not the slightest allusion to percussive action.

At last, in the *Engineer*, of October 21, 1859, he says, "The percussion [first time he used the word, after discussions with me] of this steam upon the plates would, in all probability, be quite sufficient to have broken them." Note—this is very like a part of my original explanation.

But he changes his ground, in the *Engineer* of April 19, 1861, and explains the explosion—first, by the occurrence of a *local rupture above* the water-line [how could that be if the casing had been *full* of water?]; second, the instantaneous escape of steam from *over* the water; third—the disengagement of steam from the heated water and the percussive action of the steam against the upper surface of the boiler, which might thus be rent violently open. "The obvious fact," he adds, "that the steam, in its rapid disengagement, must carry water with it, was not then dwelt upon." Observe how entirely different his first and second explanations are to each other. Instead of *collapse*, the first incident is rupture; and again, he accepts the fact that the water was not all evaporated, and that it was carried by and projected with the steam.

If then, Mr. Colburn does really dissent from my explanation of the explosion, I am curious to learn in what respects he dissents.

As I have already stated, he has not attempted to deal with my last letter. It would be easy for me to prove, from his writings and his correspondence with me, his self-contradictions, and his want of originality in this matter; a precedent can be found for everything that he claims as new. But I scarcely think it is necessary to do so at present, or so long as the points raised in my last letter remain unanswered. He has, as I have said, repeatedly declined a friendly reference to third parties, which would be better than a cumbrous process of weekly correspondence.

With respect to your appended remarks upon my last letter, I may observe that I thought the editorial function applied to tangible evidence in whatever form it might be offered; and I may add that, whatever may be the value of Mr. Harshman's theory, Mr. Colburn is indebted to Mr. Harshman for the substance of the first proposition in his enunciation of my projectile theory—that is, the first in what he calls "the series of consecutive operations" resulting in a boiler explosion—namely, "1. The rupture, under hardly, if any more than, the ordinary working pressure of a defective portion of the shell of the boiler; a portion not much, if at all, below the water-line."

I am, Sir, your obedient servant,
D. K. CLARK.

11, Adam-street, Adelphi, W.C.
October 6, 1863.

IRON WALLS AND THEIR ARMAMENT.

SIR,—I have read with interest the Papers on field and heavy ordnance, which in the course of the last few weeks have appeared in your journal. The writer has analyzed and epitomized with much care and intelligence the information on guns and projectiles which he has culled from authentic sources. These labours are valuable to the general public, who take an interest in those matters, but have not time or opportunity to have recourse to original channels.

The facts and theories promulgated, however, acquire their chief value from the aptness and truth of the deductions drawn from them. The object of scientific discussion on practical me-

chanics is to dispel ignorance and error, and open the way for inventive genius.

Availing myself of your liberality to correspondents, I beg to offer some observations on the great national question treated upon in the articles referred to.

The writer divides his subject into two parts—1. For land service, "rifled field-pieces of long range and extreme accuracy." 2. For sea service, "heavy guns, combining smashing effect and penetrative power at considerable range, without great pretensions to accuracy." In the latter class, no doubt siege guns, although for land service, are intended to be included.

This division is correct and intelligible; the two branches of the artillery question have been skilfully handled in your columns. On the first I do not propose to make any remark, except to express a wish that the construction of the American field-pieces, which have committed "such tremendous havoc" in the ranks of the opposing armies, were more accurately described than by the statement that "American parks of artillery are usually distinguished by the presence of numerous guns sufficiently like those of Whitworth and Armstrong to be regarded as nearly identical." An impression prevails in this country that Whitworths and Armstrongs differ materially in the qualities essential to a good field-gun. I will not stop now to go into that vexed question, which the Special Competitive Committee seem by some occult influences to be deterred from entering upon. It may, however, be interesting to your readers to be reminded, by the following abstract of the report of the Ordnance Select Committee, of the results obtained in a competitive trial, to "ascertain range and deflection in comparison of Whitworth's B. L. 12-pounder with Armstrong's B. L. 12-pounder gun":—

Armstrong's Gun.

Charge. lbs.	Elevation. deg.	Range. yds.	Deflection. yds.
1·50	2	1,130	4
1·75	,,	1,256	5
1·50	5	2,146	9
1·75	,,	2,358	11
1·50	10	3,568	12
1·75	,,	3,908	17

Whitworth's Gun.

Charge. lbs.	Elevation. deg.	Range. yds.	Deflection. yds.
1·50	2	1,198	$1\frac{1}{3}$
1·75	,,	1,289	$1\frac{2}{3}$
1·50	5	2,367	$1\frac{1}{3}$
1·75	,,	2,471	$1\frac{2}{3}$
1·50	10	4,222	3
1·75	,,	4,399	$6\frac{2}{3}$

The victory remained to the Whitworth, and yet, although more than two years have elapsed since those experiments took place, the Armstrongs have been and are the preferred service guns of the British artillery. So much for the justice of the Ordnance Department, which of two systems of field-guns selects the least effective for the public service. It is very desirable that data as to the character of the American field-pieces similar to those in the above reports should be published in your pages. We could then judge if the "tremendous execution and long ranges" of those guns could not be equalled by field-pieces manufactured in this country.

Coming now to naval ordnance, I see that a distinction is drawn between smooth-bore and rifled guns. The gist of the argument is that heavy cannon—150 and 200-pounders—cannot be produced in the rifled form without danger of their bursting, unless "the American plan, which is very different from ours," be followed. The American plan here referred to is afterwards stated to be the well-known Parrot gun, of which an accurate and interesting account is given in the Mechanics' Magazine of the 25th September. This cannon is described as rifled with shallow grooves and lands, each an inch in width, and having a slow twist; and the shot as a conical projectile, with rather a sharp head, and a soft brass ring cast into its breech-end. "The explosion of the shot upsets the brass ring into the shallow grooves, imparting rotary motion to the shot." We are told that "little is known in this country of the Parrot gun, and that it is beyond dispute the best in the American navy."

For the credit of British artillerists, I am happy to state that we possess a gun of precisely the same character as the Parrott, and that gun is Mr. Bashley Britten's. Without endorsing the opinion that it is the best naval piece of ordnance that can be produced, I admit it to possess great merit; and I have no doubt it would be more serviceable and more effective in every respect than the Armstrong. Like the Parrott, it is a muzzle-loader, is rifled with shallow grooves and lands, each about an inch wide; it also has a slow twist, and is fired with a charge of 1-10th the weight of the shot. The mode of stopping windage and causing rotation of the shot is in principle precisely similar—the only difference being that the soft metal cast into the breech-end is a disc of lead instead of a ring of brass. This plan is known as the "expansion system," and is among the best; superior, I think, to the Wahrendorff or compression system, which is often erroneously spoken of as Sir William Armstrong's invention. "Honour to whom honour is due." I present to your readers an abstract of a report, showing the results of a comparative trial of a 50-pounder Britten *versus* a 40-pounder Armstrong. The object was to determine "the effects of equal charges in large and small bores." In the report the following particulars are recorded:—The Britten was a rifled 32-pounder cast-iron service gun; the bore 6·375 in., the weight of the shot 50 lbs., and of the charge 5 lbs., or 1-10th; initial velocity 1,209·2; pressure on shot 415 tons, and on sides of gun 1,204 tons. The Armstrong was a rifled breech-loader, the bore 4 in., the weight of the shot 40 lbs., and of the charge 5 lb., or ⅛th; initial velocity, 1,200; pressure on shot 163 tons, and on the gun 1,964 tons.

Here, again, the Britten bore away the prize, the Armstrong lagging behind. Nevertheless, the latter are introduced in the service; and Mr. Britten, having proposed his system to the War-office for heavy broadside guns, is still waiting, as he has been for months, whilst "the question is under consideration." At a scientific meeting, Mr. Britten, plaintively but naturally, said "he thought it only fair that he should be allowed to compete with Sir William Armstrong on equal terms." Your readers, no doubt, will unanimously be of the same opinion.

Not wishing to trespass too much on your well-filled pages, I will close this letter; and if you will allow me space, I will conclude what I have to say on naval guns in another letter.

Civilian.

THE "GREAT EASTERN."

Sir,—The experience gained in the career of the "Great Eastern," renders it but too obvious that important changes are necessary to give her ordinary seaworthy and manageable quantities before she can be again started agoing. She must be cured of her rolling propensities. Bilge logs might partially check this, but would not remove the evil. What is wanted is a certain lifting power below the water line at each side, and under or outside the main breadth. It would require (judging from her model) 1,200 to 1,500 tons' displacement at each side to furnish sufficient upward force at this point to effectually do away with her liability to roll and bear her up under a press of canvas. The paddles may then be taken away and a portion of the boilers and machinery, &c., and in addition to the present screw, we would introduce two other screws, somewhat less, one under each quarter—the latter to assist in steering, and also propelling. We would then have three submerged propellers, or screws, at the stern, where they ought to be, and without canvas would doubtless make the ship go, and keep her under control. 40 to 50 ft. sliced off the thin part of her forefoot would also be a good thing. Three funnels would be plenty—two only, better. I would alter the rig by doing away with all square sails and adopting staysails and trapezium sails, say, five most in all—foremast, second foremast, main-mast, mizen-mast, and jigger mast. She may then be sent to any part of the world, and it is more than probable that she will answer and prove a success—a thing very desirable.—I am, &c.,

John Kennedy.

Whitehaven, Oct. 6, 1863.

J. GRANTHAM'S HYDRAULIC PRESSES.

Sir,—In the Mechanics' Magazine of September 2, you published an illustrated description of J. Grantham's Improvements in "Hydraulic Presses," patented on the 19th February, No. 391. I trust that, as an act of justice more than as a favour, you will allow me to refer your readers to an illustrated description of similar or rather identical improvements, which appeared in your valuable paper of the 28th August last, and which improvements were patented by Mr. Robert Lüthy on the 10th of January last, No. 87.

I enclose my card, and remain, Sir,
Your obedient Servant,
C. E. R.

London, Oct. 7th, 1863.

Miscellanea.

The Italian Government have contracted with Mr. W. T. Henley for the manufacture and laying of a submarine cable 62 miles in length, from Otranto to Avlona, which will give a route by way of Italy for messages to Constantinople, and thence to the new line *via* the Persian Gulf to India.

Four of the large iron cylinders cast at the foundry of Messrs. Aveling and Porter, Rochester, have been received at Chatham dockyard, to be used in the works now in progress for the enlargement and extension of that establishment by taking in the whold of St. Mary's Island. The cylinders, which are the largest of the kind ever manufactured for that particular operation, are intended to be used in the construcrion of the new basins and docks, the foundations for which are now being excavated. In the construction of the new basins and docks advantage has been taken of St. Mary's Creek, which intersects the southern portion of the island, and the bed of the creek, which is now being drained, will, in fact, form the site of the three basins, the united area of which will be nearly 90 acres, or about double the extent of the whole of the existing available basin accommodation at all the Royal dockyards. Up to the present time the entire work in connection with the enlargement of Chatham dockyard has been performed by convicts, of whom between 800 and 900 are daily employed.

On the 1st day of this month the new time-gun for Glasgow was fired for the first time at 1 o'clock, simultaneously with the discharge of the pieces at Edinburgh, Newcastle, North Shields, and Sunderland. The experiment was witnessed by a large number of spectators; and some interest has been awakened as to whether it may be established as a permanent regulator of city time. Until the matter is definitely decided, the gun will be fired every day at the same hour. The attention which has been called to the subject by this time-gun experiment has led to another scheme being proposed with the same end in view. Steps are now being taken to connect by an electric wire the Glasgow Observatory with one of the turret clocks in the city, for the purpose of controlling the latter by the normal clock of the Observatory, as practised so successfully at Liverpool. The controlling of a seconds clock by the same method (Jones's) is also under consideration.

The President and Government of the Peruvian Republic have for some time past been engaged in the most active measures to develop the resources of that country, and especially to open up the river Amazon, and its numerous large branches in the interior, to European commerce and enterprise. For this purpose several small screw steam-vessels have been constructed at the premises of Messrs. Samuda, and other firms on the Thames, which have already been forwarded to their destination; and a squadron, consisting of the "Arica," the "Eliza," and another steam-vessel, are about to sail, taking out an immense iron floating-dock, steam-engines, planing and drilling machines, steam-hammers, and the entire details of an engineering plant for the establishment of a factory, to make and repair every kind of machinery used for the cultivation and preparation of cotton, tobacco, rice, sugar, &c. The whole arrangements are under the superintendence of Mr. Clark, chief engineer, who will sail with the expedition, and will take out with him a considerable number of

skilled engineers, smiths, and other mechanics, who have been engaged at a liberal rate of wages by the Peruvian Government, which will also grant a free passage for the families of married men. During the past two years several young Peruvians, sent over by the Government for that purpose, have been learning the profession of engineering at the premises of Messrs. John Penn and Son, Greenwich. The importance of improving that immense territory, east of the Andes, was first recognized and acted upon by the late President of Peru—General Castilla—whose enlightened views are fully endorsed by the President now in office.

Spiegel Eisen is getting much into use at Sheffield, in the Bessemer process (as a carbonizer), and also for making steel, the charcoal quality suiting very well for this purpose, on account of the large proportion of manganese and carbon it contains. The Government are now experimenting on this class of iron at Woolwich (with the intention, it is understood, of using it, like Krupp of Essen, in the manufacture of steel cannon). For rolled armour-plates it is also likely to come much into use, being used in a process which we are at present not at liberty to name. There are various sorts of spiegel iron, but the charcoal-made quality is considered to be the best suited for the purposes named.

The *Mining Journal* states that a very compact and efficient form of blast-engine is at present being manufactured by Messrs. Wm. Coulthard and Sons, of the Park Ironworks, Blackburn; the chief feature, however, is the substitution of the india-rubber ball valves for those usually employed. The engines are described as applicable to blast-furnaces, foundries, &c., and may be constructed for any pressure of blast from 3 lbs. to 30 lbs. on the square inch. The ordinary cost for foundation is avoided, and the machine occupies a very inconsiderable amount of space.

From the quarterly return of vessels in course of construction at Sunderland, it appears that there are a total of 101 vessels now on the stocks, 47 of them being sold, and 54 remaining unsold. 17 are of iron, 3 of wood and iron, and the remainder wood vessels. Two of the iron vessels are screw steamers—one of 690 tons, building by Mr. Laing; and the other 790 tons, by Messrs. Pile, Hay, and Co. Mr. Laing is building an iron ship of 1,320 tons register; Messrs. Pile and Co., two iron ships of 1,050 and 1,033 tons respectively; Mr. Smurthwaite, a wood ship of 1,150 tons; and Mr. John Watson, a wood ship of the same dimensions. The aggregate tonnage of the 101 vessels amounts to 43,976, an average of 435 tons each.

A large and powerful engine has just been made by Mr. Andrew Barclay, Caledonian Foundry, for Messrs. Robb, Greig and Co., carriers, and is intended to run on the road between Glasgow and Kilmarnock. It was taken out on trial on Friday afternoon, and, followed by a large number of persons, made a circuit from Mr. Barclay's works up the front streets of the town. In returning it had to run up Langland's Brae, and this it did in a very satisfactory manner. The machinery for turning corners resembles outwardly the means used for steering a ship. The engineer turns a wheel with handles, to the axle of which is placed an endless screw, which communicates motion to the shafts underneath.

Telegraphic despatches of twenty words are now forwarded in Prussia up to a distance of forty-five miles for 9d.; for any distance between forty-five and 200 miles similar despatches cost only 1s.

Advices from Lyons state that a process is talked of by which silk can be liquified, and the produce of the worms kept in casks for artificial re-issue in filaments susceptible of quite a novel form of manipulation. It would appear that what is meant bears some affinity to the treatment and uses of gutta percha. It is already known that surgical science has turned to account for ligatures of human arteries, the yet unspun contents of the worm or caterpillar before it enters the cocoon.

Mr. John Key, of the Whitebank Engine Works, has laid down the keel of a large iron vessel at his ship-building yard near Kinghorn, at present in course of completion. It is to be an iron screw-steamer of 800 tons, constructed to carry 220 first and second-class passengers, and fitted up with engines of 160-horse power. Three orders have already been received for iron vessels for the passenger trade—one from a London and two from an Australian firm; and the keel of one of the Australian vessels has been laid. The new yard, which is about 400 ft. long by 250 ft. broad, is situated on a partly natural and partly constructed slope, admirably suited for the purpose, and will give accommodation for four iron vessels of 1,000 tons each. At the head of the slip are the workshops, which consist of a double building, one side of which is a single storey for the blacksmiths' shop, 220 ft. by 38 ft.; and the other side is in two storeys, 220 ft. long by 40 ft., for a moulding loft and machine shed. This new branch of industry, which to all appearance will be carried on on an extensive scale, will be of great advantage to the town of Kinghorn. We understand that steps have already been taken to form a building society to accommodate the workmen with suitable houses.

We are requested to state that as the Fenton Memorial Fund is not yet closed, Mr. Joseph Freeman will take an opportunity of communicating the result to those who have so kindly contributed.

An eminent Parsee merchant firm in the city of London has presented £2,000 to the Royal National Lifeboat Institution, through its chairman, Thomas Baring, Esq., M.P., to enable it to form a lifeboat establishment on the English coast, and permanently to keep it up. Their firm is now under dissolution; and in order to show their gratitude to the people of the great metropolis, from whom they have received for many years every courtesy, they have presented this munificent amount to this benevolent institution.

An iron-clad frigate, built for the Italian Government, has just been launched from the building-yard at La Seyne, near Toulon. She is of 4,300 tons measurement, has engines of 700-horse power, and is to carry 36 guns. She takes the name of "San Martino." Her bow below the water-mark is formed so as to act as a steam ram. She is everywhere covered with thick plates; but those towards the bow, which would be the most exposed to the force of any shock, are much heavier than the others.

The report of Mr. Joseph Dickinson, on the inspection of mines in the North and East Lancashire or Manchester district for the year 1862 has been issued. He states that the explosions of fire-damp, although fewer than last year, and unattended with large loss of life, were too numerous to be creditable to the management. Accidents occurred which might have been prevented if some person of experience was appointed to manage the collieries. The decrease compared with the preceding year was 11 accidents and 23 deaths, and the total number of accidents during the year was 56 and the number of deaths 59. The accidents were classified as follows:—Firedamp, 9; fall of coal, 6; fall of roof, 14; breaking of rope and chain, 1; whilst ascending or descending, 7; falling from part way down, 4; miscellaneous, 1; explosion of powder, 1; on incline planes, 3; by trams, 2; underground, 1; boilers bursting, 2; miscellaneous on surface, 5; total, 56. The deaths were, from firedamp, 10; fall of coal, 7; fall of roof, 14; breaking of rope, 2; while ascending and decending, 7; falling from part way down, 4; miscellaneous, 1; explosion of powder, 1; on inclined planes, 3; by trams, 2; underground, 1; boilers bursting, 2; miscellaneous on surface, 5; total, 59. There had been 30 non-fatal explosions of firedamp, and 27 non-fatal explosions of blasts and blasting powder. The causes of accident principally arose from there being no viewer or person of sufficient previous training to give directions. Instead of such advice being provided, the underlooker was left to gain knowledge from his own experience, and the result was that it was unnecessarily obtained through the occurrence of accidents.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 572, 574.
Boilers and Furnaces, 564, 568, 577.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 557.
Ships and Boats, including their fittings, 570, 571, 575, 587, 590, 596, 602.
Cultivation of the Soil, including agricultural implements and machines, 558, 580, 598.
Food and Beverages, including apparatus for preparing food for men and animals, 555, 567, 584.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 552, 553, 561, 569, 582, 585, 588, 593, 595, 601.
Buildings and Building Materials—*none.*
Lighting, Heating, and Ventilating, 551, 556, 560, 565, 579, 605, 606, 609, 610.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 563, 566, 576, 583, 591, 594, 600, 604.
Metals, including apparatus for their manufacture, 589.
Chemistry and Photography, 586, 611.
Electrical Apparatus—*none*
Warfare, 581.
Letter-Press Printing, 578.
Miscellaneous, 554, 559, 562, 573, 592, 597, 599, 603, 607, 608.

551. H. Fehr. *Improvements in the treatment of mineral oils.* Dated February 27, 1863.

This invention has for its object improvements in the manufacture of petroleums, rock oils, Cuba rock oil, Rangoon oil, or earth oil, by treatment of carbonic or carbonic and chlorine gas together, produced by the action of acid on lime or chloride of lime. The inventor first takes a certain quantity of petroleum, and adds a certain proportion (according to the quality of the oil) of lime, and then adds acid. He allows the gas to act on the oil until the latter has acquired the necessary quality and the desired smell. *Patent abandoned.*

552. E. T. Hughes. *Improvements in machinery or apparatus for doubling or twisting yarn, thread, braid, rope, or similar articles.* (A communication.) Dated February 27, 1863.

For doubling or twisting two or more strands or threads at one operation into a cord or thread, the inventor uses a fly-wheel placed in a vertical position, so as to revolve on its centre, motion being given to it by a driving strap or band on the boss of the fly-wheel, or a small wheel fixed behind it, with a groove or grooves on its periphery to guide the driving strap or band. On the front surface of the said vertical fly-wheel are placed other small wheels, with frames to hold each a bobbin containing the material to be doubled or twisted into a cord, band, or braid, the said small wheels being also grooved to receive a band or strap to give them separate motion; the number of the said small wheels vary according to the number of threads or strands to be twisted together, a spring acting on each bobbin to keep the strands to a regular tension. There is also a fixed pulley with grooves placed in front of the fly-wheel, and on the same shaft, which pulley must have as many grooves as there are strands in the cord, or, in other words, as many grooves as there are bobbins of thread. When a cord is required to have a thread in the middle, a bobbin is fixed in front of the pulley containing the centre thread, which it gives off as required, whilst the other threads or strands lap round the centre thread in a spiral form, the bobbin carriers and fixed pulley being connected to the fly-wheel as already described. Motion may be given to the fly-wheel either by hand or power, which turns from left to right, the bobbin carriers being turned in a contrary direction by means of the strap or belt round the fixed pulley. The two contrary rotations of the fly-wheel and bobbin carriers also produce two twistings simultaneously in contrary directions; the first operates on each strand in the space contained between the bobbin and the point of junction of those strands which unite for twisting; and the second works the twist or cord. The bobbin carriers make as many revolutions on their own axis from right to left as the fly-wheel makes from left to right. The rotation of the fly-wheel produces a separate twisting on the strands, equal to the twisting it produces on the cord, and the contrary rotation of the bobbin carriers also produces a twisting of those strands in the same way equal to the twisting that is produced on the bobbin carriers by the fly-wheel, which shows that the twisting of the strands is double that of the cord. *Patent completed.*

553. J. Carver. *Improvements in the arrangement or fixing of combs in machines employed in the manufacture of bobbin net or twist lace.* Dated February 27, 1863.

The combs employed in bobbin net or twist lace machines are fixed on bars called comb bars. These comb bars, as hitherto used, have been so made and arranged that they do not admit of being conveniently opened or separated from each other sufficiently apart to allow of the introduction and working of the large number of guide bars usually required for producing variegated, ornamental, figured, fancy, or other work, and it has been found that the carriages with the arrangement heretofore employed are liable to enter wrong combs, and thus produce what is known in the trade as wrong gates, thereby injuring the carriages and combs, and involving expense and loss of time. The object of this invention is to remedy these evils. For this purpose, in combination with shortened combs fixed on the comb bars, the patentee uses in each machine an additional set of extra combs, fastened upon and working with each of the landing bars, and the combs which he uses on the comb bars, he forms much shorter than those which have been hitherto used, so as to allow of the effective working of the combs fixed on the landing bars. When the machine is what is called "closed," an end of the carriages—when the carriages are in the machine—will be in the combs on each landing bar, and the carriages will at the same time be in the combs on each comb bar, so that the carriages will be held firmly in the combs on the landing bars, and will, therefore, not be liable to enter wrong combs or produce wrong gates. *Patent completed.*

554. J. A. Coffey. *An improved method of, and apparatus for, controlling and facilitating locomotion, whether on land or on water.* Dated February 27, 1863.

This invention consists in adapting to engines or apparatus for either land or water locomotion, reservoirs or accumulators of power, obtained by the progression of a

carriage or other vehicle, or of a vessel—as, for instance, while a carriage or vehicle is descending hills, or acquired in a vessel under other circumstances, or unexpended at the time of stopping—in which such power may be collected ready to be given out or usefully expended when it is desired to get again into motion, or when it is desired to ascend another hill or incline. *Patent completed.*

555. J. Fry. *Improvements in mashing machinery used in making fermented liquors.* Dated February 27, 1863.

This invention consists—1, in regulating and indicating the supply of malt in and to mashing machinery, so that the mashing shall be effected in a better manner than heretofore. This regulating and indicating is effected by the use of a fluted, corrugated, or ribbed roller, or a roller with boards, projections, or rakes. This roller works in a box or case which has hinged thereto a regulating flap or board, which can be adjusted by means of an adjusting screw or mechanism, so as to regulate the amount of malt to be delivered to the mashing machinery, and by marking the adjusting screw the indicating will be attained. Or this may be effected through the intervention of gearing acting on an indicating dial. At the bottom (or near to the bottom) of this regulating mechanism, a slanting piece may be provided to be inserted into the mouth of the mashing machinery to prevent back action upon the malt and liquor. The mashing machinery it is preferred to make with a longer tube than as ordinarily practised, and placed perpendicularly (though the horizontal position could be adopted) with the revolving rake working therein. Instead of one tube and rake the inventor can connect several tubes and rakes, so as to communicate with each other and form a complete and compact system of mashing machinery. He also purposes jacketing these tubes with steam or hot air, gas, or vapour jacketing, using a thermometer or other indicator for the convenience of the operator. He also prefers to use an octagonal instead of a square shaft or spindle revolving within the tubes, provided with blades instead of rakes, and this will enable rakes or blades to be fixed inside the tube to act as cleaners. *Patent abandoned.*

556. R. A. Brooman. *A new method of and apparatus for boring into water and gas supply pipes, and fixing branch pipes thereon.* (A communication.) Dated February 27, 1863.

This invention consists in a method of and apparatus for boring into water and gas supply pipes, and fixing branch pipes thereon without interrupting or interfering with the supply, as hereafter described. At the point where the supply pipe is to be pierced, the inventor places under and round it a metal strap or clip, brings the ends of the strap upwards, and passes them through flanges, spreading out from the bottom of a tube; between the supply pipe and this tube he places a lead, gutta percha, or other suitable washer, and makes a hermetic joint by tightening the strap by nuts which bear on the top of the flanges, and screw on to the ends of the strap. The tube has fitted in it a tap, and just above the tap the tube is flanged. For the purpose of boring into the supply pipe there is another flanged tube bolted to the tube first mentioned; in the upper part of this second tube a stuffing-box is fitted, and a head for supporting a pressure screw is bolted to flanges on the top thereof. The shaft of a boring bit is carried through the stuffing-box, and through the water or gas way in the plug of the tap fitted in the tube attached to the supply pipe. A boring bit is fitted in the lower end of the shaft, while the pressure screw passed through the head before-mentioned bears on the top thereof; a ratchet brace imparts the necessary motion to the bit, and the supply pipe is thereby pierced. The stuffing-box at the top of the second tube prevents the water or gas escaping. The boring-shaft and bit are drawn up through the passage in the plug of the tap, which is then closed. The parts are removed from the tube in which the tap is fitted, and the tube with its tap and the strap remain permanently attached to the supply pipe. The branch tube or pipe may be extended as required. *Patent completed.*

557. A. Dudgeon, G. F. L. Meakin, and E. E. Allen. *Improvements in the construction of underground railways or subways, and in carriages to be used or worked herein.* Dated February 27, 1863.

This invention may be generally described as a method of constructing the sides and roofing of subways or underground railways by the removal in the first instance of such an amount of earth only as shall be sufficient to lay, embed, or sink such sides and roofing separately, or at the same time, replacing the said earth, and making the roadway good over the subway, leaving the earth between the said sides and under the said roofing to be subsequently excavated and removed in any convenient manner through open cuttings or shafts, at places where no great amount of traffic exists, or where stations may be intended to be formed, and the ground or land be in possession of the company or person constructing the said works. After the excavation or removal of the earth in the tunnel or subway shall have been effected, the bottom may be formed and made good, and the subway consequently finished in considerably less time than would be possible were the whole of the earthwork removed down to the base or floor of the subway at one and the same time. The invention consists—2, in constructing the carriages to be used or worked in subways constructed as above described. Great diminution in the height of the same may be made, by forming the floors of the said carriages nearer to the level of the rails, and below the axles of the wheels, the said axles passing under or between any pair of seats in a suitably constructed passage made from side to side of the carriage. The wheels of such carriages the patentees propose to place in recesses formed in the sides of the carriages, such recesses being open in front, and made to contain the springs and grease-boxes and break blocks. To enter such carriages no platform would be required, or one raised a few inches only from the level of the rails, and a waste of vertical light of from 2 to 3 ft. avoided. The back of the recess for the wheels would in this case take the place of ordinary horn plates. *Patent completed.*

558. W. Gray. *Improvements in the manufacture of beaters for thrashing machines.* Dated February 27, 1863.

This invention is not described apart from the drawings. *Patent completed.*

559. W. Clark. *Improvements in pumping and forcing water, and in apparatus for the same.* (A communication.) Dated February 27, 1863.

This invention is not described apart from the drawings. *Patent completed.*

560. V. D. Delahaye. *Improvements in apparatus for cleaving and excavating pit coal and rock or earth.* Dated February 27, 1863.

This invention has for its object the more regular, rapid, and economical execution of the cuttings required to be made for the separation of the mass of pit coal and rock or earth intended to be excavated, and for boring holes therein. For this purpose the patentee employs a carriage and travelling tool combined with suitable guiding apparatus. The apparatus consists of a frame or frames, adjustable as to height or length, with the two ends capable of being caused by the pressure of a screw to hold firmly against the top or the partition walls of a mine or other cavity required to be excavated. The frames form guides for slides worked by means of a lever and ratchet, and a pulley with a cord round it, such slides having connected to them by means of suitable cross-framing the carriage for the travelling tool, which carriage has holes in it for the insertion of a forked bar or bars, by means of which the carriage may be worked as required along the cross-framing, friction rollers being applied to the carriage in order to facilitate its motion thereon. By means of the foregoing arrangement of apparatus the operations of the workman will be made to consist in guiding the travelling tool, which in some kinds of excavating operations will work after the manner of a plane, whereby he will be relieved from the more trying operation of working as usual with a pick, and in the operation of boring the tool will be readily turned as required. *Patent completed.*

561. J. H. Johnson. *Improvements in machinery or apparatus employed in the preparation or treatment of hemp and other textile materials.* (A communication.) Dated February 27, 1863.

This invention consists in a peculiar construction and arrangement of feeding apparatus for feeding the various machines employed in rendering the fibres of hemp and other textile materials fine and supple. It is proposed to construct the feeding apparatus in such a manner that tufts or handfuls of the fibrous material will be introduced between and amongst the layers or lap already formed upon the feeding table or endless cloth, with a view to the formation of a fleece or lap. This lap is thus composed of several successive layers, so disposed that each fresh layer, as fast as it is introduced into the main lap at a certain point, will be covered both above and below by the layers already introduced, and forming the feeding lap or layer of the machine. The improved feeding apparatus consists, essentially, of two open frames hinged upon the axis of the fluted feeding roller, which presses upon the lap contained on the feeding surface or table. One of these frames is rather shorter than, and works within, the other, but on the same centre of motion. By successively lowering and raising these frames, the handfuls or tufts will be deposited in regular order in the layer on the table. After placing a certain quantity of the fibrous material to be operated upon under the cross bar of the longer frame, which is turned down for that purpose, the shorter frame is elevated in order to divide the layer which is about to pass under the grooved feeding roller. Another handful of fibre is now interposed by placing it over the cross bar of the longer frame, when it is presently drawn in under the roller along with the rest of the layer. By this mode of feeding, whereby the handfuls are introduced into the middle of the lap or layer, greater regularity of feed is obtained, and the clogging or choking of the machine is prevented. *Patent completed.*

562. B. West. *An improvement in metallic pens.* Dated February 28, 1863.

This invention consists in making each pen double—that is to say, the piece of metal of which a single pen is now made is so shaped and cut as to form two pens, one at each end of the piece of metal. *Patent abandoned.*

563. G. Royle. *A new or improved apparatus for creasing or marking rouches.* Dated February 28, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

564. W. Hadfield. *Improvements in steam boilers and in the arrangement of flues in connection therewith.* Dated February 28, 1863.

This invention is applicable to boilers with internal flues, the objects being to impart strength, to obtain a larger internal and external heating surface, and to arrange the flues in the most advantageous manner to equalize the heat, so as to avoid or reduce the injurious effects of unequal expansion and contraction. In performing the invention, the patentee places the fire grate or grates in one or more flues, which deliver the products of combustion through openings at each side of the boiler into side flues, which are brought back towards the front of the boiler, and then unite in a flue passing under the whole length of the boiler. The products of combustion then enter an internal flue or flues which deliver them through openings at each side of the boiler to side flues which are in communication with the chimney. *Patent completed.*

565. J. W. Friend. *An improved gas meter.* Dated February 28, 1863.

This invention consists in employing, in lieu of the ordinary measuring drum or chamber, a vessel of cylindrical form, mounted upon a suitable stand, and fitted with a piston, so as to work freely within the same, and admit of being actuated by the pressure of gas through the meter. The said piston is packed with mercury, and provided with a piston rod passing through a stuffing box on the top or cover of the cylinder, to which also two parallel plates are fixed. These parallel plates carry a horizontal spindle, which receives motion through the medium of toothed wheel and pulley gear direct from the piston rod; a four-way tap is employed in connection therewith, as also a small gravitating lever and alternating stop stud motion, by the rising and falling of which the plug of the tap is carried round to the quarter port, and again on the reverse side in a like manner at each up-and-down stroke of the piston, whereby the gas is admitted and regulated to the meter and the indicators set in motion. *Patent abandoned.*

566. F. Fabra. *New application and combination of materials to be employed in the manufacture of skirtings.* Dated February 28, 1863.

This new material for skirtings is formed by weaving devices in imitation of "sewed muslins," the said devices being either woven in the piece of skirting, or attached by sewing. *Patent abandoned.*

567. J. Maxfield. *Certain improvements in brewing, and in apparatus employed therein.* Dated February 28, 1863.

This invention is designed for the purposes of keeping the yeast arising from malt liquors separate from the liquor as it rises during the process of fermentation, and for retaining the carbonic acid gas in the malt liquor, and preventing the too free entrance of air. The improvements consist in the employment and use of a cover or lid floating upon the surface of the malt liquor, and furnished at the edges with india rubber or other elastic medium to form an air and water tight joint between the edge of the cover and the inside of the vat in which the liquor is placed to ferment. This floating cover is provided with a tube extending upwards, through which the yeast passes and falls on the outside of the cover. Valves are also employed in the cover, opening inwards, and connected with tubing by which any liquor the yeast may contain passes again into the vat. The patentee also employs within the vat coils of piping supplied with hot or cold liquid to regulate the temperature of the liquor, as usual, and taps for drawing off the malt liquor from beneath the cover when the barm is separated. By the use of this floating air-tight cover the height of the liquor in the vat becomes immaterial, and the free escape of the carbonic acid gas is also prevented. *Patent completed.*

568. S. Williamson. *Improvements in the construction of furnaces.* Dated February 28, 1863.

This invention applies to furnaces for steam boilers, furnaces used for the conversion of iron into steel, and to every other kind of close furnace having a flue to carry away smoke or the products of combustion. The improvements consist of an arrangement of perforated bricks and air passages introduced into bridges beyond the grate bars, whereby combustion is promoted and smoke consumed (and in cases where applied to steam boilers, without the disadvantages which arise from bringing cold air in contact with the hot surface of the boiler). *Patent completed.*

569. D. Collinge. *Improvements in machinery or apparatus for cleaning, steaming, and preparing cotton and other fibrous fabrics to be spun.* Dated February 28, 1863.

This invention consists in attaching to the machine generally known as the Oldham willow, the ordinary fan, with additional apparatus for the purpose of more effectually cleaning out and steaming the fibrous materials. The patentee attaches to the willow two endless bands or aprons made of laths or other suitable material. One of the said bands or aprons acts as a feeder, and the other as a deliverer, both of which are rendered self-acting by suitable gearing. An attendant is required to feed the material to the willow, which falls on the feeder, and passes through the willow to the delivery band, and is conveyed to a fan in motion, which is surrounded by a grid to allow the dirt or refuse extracted by the quick motion or revolution of the blades to fall through it. The material thus cleaned and opened passes through the fan into a wire tube, which conveys it into a steam chamber, any remaining refuse or dirt falling through the said tube, giving the fibrous material an additional cleaning. He supplies steam to the steam chamber by means of pipes, so that, as the fibrous material enters the chamber from the wire tube, the steam from any convenient number of pipes in different directions penetrates and saturates it, thus cleaning and steaming the fibrous materials in one continuous operation. *Patent completed.*

570. E. Paine. *Improved apparatus for facilitating the cleaning of vessels' bottoms while afloat.* Dated February 28, 1863.

This invention consists of an oval compressed egg metal, or other suitably shaped hollow vessel, formed of iron or other suitable material, surrounded on the outside by a series of brooms or brushes, made from bristles, cocoa fibre, piassava, or other suitable material, cocoa, india rubber, or other suitable matting, alone or in combination with brushes or brooms. The sides and ends the patentee provides with suitable eyes, or other means for connecting guy-ropes thereto, in such a way that the said eyes will not come into immediate contact with the ship's sides or bottom when in use, thereby preventing injury thereto. One of these guy-ropes he connects to the front, and another to the rear end, and one to each side of the hollow vessel. The end guy-ropes he prefers to connect to the said ropes by bridle ropes. This improved apparatus may be used as follows:—One of the end guy-ropes is carried through a block attached to the under side of the bowsprit or jibboom end, and one of the side guy-ropes is passed under the vessel's bottom and through a block on the fore yard and on to the deck; the rear guy-rope is now carried outside of the vessel, clear of the rigging, through a block attached to the end of the mizen-boom or other spar projecting over the vessel's stern, and bent to the deck. The hydraulic scrubber is next thrown overboard, and the guy-rope passed under the vessel's bottom hauled on and let go alternately, as often as may be found necessary. The fore guy-rope may now be slacked off a little, and the yard slightly braced up and the operation

posted all along one side of the vessel, removing the side blocks on the fore yardarms to the main yardarm, and so on, after which the same operation is to be performed on the other side of the vessel. To avoid the probability of the guy-ropes fretting in passing under vessels having deep and sharp-edged keels, the patentee has designed several modifications of a creeper to travel along the keel, which creeper is provided with a "live" or "dead sheave" or pulley, as well as an antifriction chain or rope, in lieu of the ordinary guy-ropes. *Patent completed.*

571. T. E. Symonds. *Improvements in the construction of screw-propelled ships, and in the arrangement and mode of disconnecting, withdrawing, and lifting screw propellers.* Dated February 28, 1863.

This invention relates to twin or double-screw ships built of iron, and having one or more keels, each screw being overhung, or having no outer bearing. The invention will be fully described in a future number of this journal. *Patent completed.*

572. J. Penn. *Improvements in escape or relief valves for the cylinders of marine and other steam engines.* Dated February 28, 1863.

According to this invention, the patentee applies instead of weights and springs the pressure of the steam to keep the escape or relief valves in their seats. For this purpose he places the valves enclosed in cases on any convenient part of the cylinders sufficiently high for any water to pass by means of pipes into a separator in the main steam-pipe of the engine, or to the main steam-pipe itself, where the position of the latter will admit of the arrangement. It will be seen that the valves are kept in their seats by the difference between the pressure of steam in the main steam-pipe and the cylinder, and also in consequence of the difference of area between the outer and inner surfaces of the valve. *Patent completed.*

573. J. Courtenay. *Improvements in obtaining motive power.* (A communication.) Dated February 28, 1863.

This invention consists in producing motion by changing (increasing or diminishing) the specific gravity of an elastic fluid, the change being effected by revolving weights. *Patent abandoned.*

574. E. Hayes. *Improvements in supplying water to surface condensers of marine engines.* Dated February 28, 1863.

For the purposes of this invention, in constructing and arranging surface condensers on board ships or vessels propelled by screw or submerged propellers, the outer ends of the outlet pipes of the surface condensers are placed near the screw or the submerged propellers. The supply of the water to the surface condensers is by pipes passing through the ships or vessels, so as to admit of a free flow of water to the surface condensers. By thus constructing and arranging the surface condensers of marine steam engines, the action of the submerged or screw propellers will cause the condensing water to be constantly removed from the outlet ends of the outlet pipes of the surface condensers, and the pumps heretofore employed to facilitate the passage of the condensing water through the surface condensers may be dispensed with. *Patent completed.*

575. S. Bateman. *Improvements in the manufacture of wire rope and cordage, and in the machinery employed therein.* Dated February 28, 1863.

This invention is not described apart from the drawings. *Patent completed.*

576. G. Haseltine. *Improvements in sewing machines.* (A communication). Dated February 28, 1863.

These improvements are situated below the bed-plate of the machines, and relate to a hollow grooved revolving hook used instead of a shuttle; to a flanged spool holder which works in the groove on the inside of the hook; to the use of an expanding and contracting spindle for the lower spool; to a spool guard, which is constructed to prevent friction of the needle-thread upon the under thread and spool; to a hook for taking up and controlling the slack of the needle-thread as it passes from the point of the revolving hook, thereby preventing its being tangled; to the means and manner of regulating the tension of the lower thread; to using the lower thread direct from the spool; to an elastic shuttle or knot stitch; and to the manner of combining and arranging the said hook, spool holder, and guard. *Patent abandoned.*

577. O. Murrell. *Improved arrangements for generating steam in steam boilers and other vessels, and for heating the liquid contents thereof.* Dated March 2, 1863.

This invention consists in causing the water in steam boilers to pass from the lower part thereof through a series of horizontal bent pipes, constituting the fire bars of the furnace of the boiler, the said pipes extending in a longitudinal direction up to the bridge of the furnace, and then in a zig-zag direction across the face of said bridge. Thence a smaller pipe passes from the end of the uppermost of said zig-zag pipes to the front of the furnace, and turns upwards outside the front of the furnace, and is finally connected to the boiler at the front thereof at a point above the level of the water therein. The pipe employed to convey the water from the boiler, as above stated, passes outside of the boiler, and extends downwards nearly to the bottom of the ashpit, then bends upwards, and is connected to a cross pipe situated within the furnace, and to which the series of hollow fire bars before mentioned are connected. By means of this bent pipe throttling of the water in the said bars or pipes is prevented. The aforesaid pipes are fitted with suitable cocks for feeding, stopping, turning-off, and gauging or testing the state of the heated water passing through the same. An important feature in this invention consists in adapting underneath each of the longitudinal pipes in the furnace a V-shaped plate or shield for protecting the pipes from the action of cold air. *Patent completed.*

578. F. Tolhausen. *Improvements in cloth blankets, and other fabrics to be used in machinery for printing fabrics, paper-hangings, and letter-press.* (A communication.) Dated March 2, 1863.

This invention relates to the general and systematic use of flock, floss, fancy or waste silks, for those cloths or fabrics which are employed in covering printing or inking rollers, printing tables, and the like implements. When used for printing or inking rollers, the improved cloth is made in two layers of twilled fabric of silk floss and other similar material, which are united by a layer of india rubber laid on in the liquid state. When used for printing blankets ("doubliers"), which are lying under the fabrics and papers in the process of printing, a plain shed will answer the purpose, the material employed in both cases being silk of the kinds described. *Patent abandoned.*

579. J. W. Burton. *An improved mode of refining and purifying oils.* Dated March 2, 1863.

The patentee claims—1, the use of mimotannic acid for refining and purifying oils and other fatty matters, as described; 2, the use for the same purpose of methylated spirit in combination with mimotannic acid, as described; and, lastly, the use of nitric and sulphuric acid, and the gases derived therefrom, for refining and purifying oils, and other fatty matters, when such oils or fatty matters have been previously purified by means of mimotannic acid or similar tannin matters, as described. *Patent completed.*

580. A. F. Pagny. *A new agricultural implement for cultivating tubercles, roots, and all oil plants.* Dated March 2, 1863.

The agricultural implement forming the subject of this invention is a ridge or bouting, and, at the same time, a roller plough. It is composed of a ploughshare with double mould board, smaller than for ordinary bouting ploughs, and of four conical rollers acting on the inclined plane of the ridges. The share (the main object of which is not the bouting or ridging) breaks the subsoil, cleans the water furrows, and thus prepares the work of the rollers which follow it. *Patent completed.*

581. G. Hawksley and T. Bissell. *Improvements in powder chargers.* Dated March 2, 1863.

This invention consists in constructing the chargers of powder flasks—that is, the appliances fixed on powder flasks, for measuring and pouring the charge of powder into guns and rifles. Hitherto, there have been two chief parts in such articles—a fixed tube or cylinder, and a moveable tube with a contracted mouth. The moveable tube has had notches cut in it, and an inclined or straight slit, into which the notches upon the moveable tube has been set for use by a pin or stud inserted in the fixed tube entering one or other of the notches in the moveable tube; there has been no means, however, of regulating the capacity of the charger to any point intermediate between any two notches. Now, this invention consists in fitting an upright parallel with the fixed tube, in connecting the moveable tube to a bar having an aperture through it into which the upright enters, and on which it is free to slide up and down, taking the moveable tube with it. A set screw attached to the bar on the moveable tube fixes it at any desired height on the upright. The patentees mark graduated scales of grains and drams on the fixed tube, and make apertures in the lower part of the moveable tube to read the scales. In some cases they dispense with the upright, and apply a set screw to the moveable tube to fix it at any height on the fixed tube. Another part of the invention consists in fitting a spring lid, which moves horizontally to close or open the mouth of the moveable tube. This horizontal spring lid is also applicable to powder-flask chargers however otherwise constructed. *Patent completed.*

582. E. Habel and E. Luckow. *Certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous substances.* Dated March 2, 1863.

This invention is carried into effect as follows:—The spindle upon which the cop or bobbin is formed, has a bearing in a footstep in a copping or lifting rail, and is supported at a higher point by a hollow stud, upon which revolves a brush terminating in a cylindrical case, which re-encircles the spindles, and is sufficiently wide to admit the formation of a cop or bobbin, or a tube or bobbin within it, and is driven by a band passing round a pulley thereon. From the upper edge of this case a wire extends, either short and simply bent, or formed like an arch or cone: when the arch is employed it is provided with an eyelet (formed in a piece of metal by a round hole, and a slot diagonal to it) at the apex, and others at convenient distances on the wire if required, by which means the yarn passes, and is spun directly from the drawing rollers to the cop or bobbin. The second portion of the invention is particularly applicable to spinning-cops, and consists, first, in the employment and use of a short spindle, having a plate or washer at the lower end; the spindle is steadied at its upper extremity by entering an aperture in a bent wire or rod extending above the spindle, somewhat in the form of an arch or cone, the ends of such wire being secured in a collar which is attached to the driving pulley, and the lower end of the spindle is steadied by entering an aperture in a vertical rod or elongated footstep passing through the stud supporting the whole in the framing. A third part of the invention, consists in a novel method of effecting a drag on the solid spindle by the means of a curved or straight piece of metal, upon which the plate or washer bears, and which is attached to and actuated by, the means of a wire passing down a slot in the rod or spindle footstep, and terminating in a tailpiece formed at right angles, and which are connected together by a rod or wire throughout the length of the machine. The effect of the drag upon the washer and spindle will decrease as it approaches the spindle or centre, and increase as it is turned outwards to come in contact with a longer surface. The drag is applicable to all descriptions of spinning and doubling machinery, where any drag is employed. The copping motion may be obtained by cams as in the ordinary manner, or by the improved means of a rotating or semi-rotating disc having two studs acting upon a bell crank lever, such studs being caused to diverge from the centre of the disc in a self-acting manner by means of right and left handed screws and spur wheels, oval eccentric spur gearing or cam being employed to drive the aforesaid disc, by which means a variable motion is obtained to "shape the cop." A fourth part of the invention relates to a novel arrangement and construction of apparatus to act as a guide for delivering the yarn on to the cop or bobbin, and consists in a light metallic ring peculiarly formed so as to encircle each vertical wire of the aforesaid arch or cone, so as to prevent unequal strain. This ring is furnished with an eye or hook for the yarn, and revolves with the cone or arch, and within a metallic channel or case which rises and falls like the ordinary lifting rail, and thus the yarn is wound on the cop. *Patent completed.*

583. T. Taylor. *The manufacture of a new or improved fabric, and its application to the formation of ornaments for fire-stoves and other decorative purposes.* Dated March 2, 1863.

This invention consists in the manufacture of a slight woven fabric of dressed, polished, or stiffened cotton, yarn, or thread, or other suitable material, which fabric, when cut into strips, presents a fringe formed by the weft material, on each side of the body or warp which lies down the centre. The inventor twists this slight double fringe, which imparts to it a light feathery appearance, and he applies it to the formation of ornaments for fire-stoves and other decorative purposes. *Patent abandoned.*

584. O. Garton. *An improved method of applying heat in the manufacture and refining of sugar, and in malting, hop drying, brewing, distilling, and vinegar making.* Dated March 2, 1863.

This invention consists in applying hot water or other fluid as the heating medium, the heat being sustained by self-acting circulation through the pipes from a boiler either contiguous to, or at a distance from, and at a lower level than, the sugar to be acted on. *Patent completed.*

585. J. S. Wells. *Improvements in the manufacture of stockings and other looped fabrics made in knitting machines.* Dated March 2, 1863.

For the purposes of this invention, in order that the selvages and seams at the back, and the sevages and seams at other parts of stockings, and also the selvages and seams of socks, drawers, waistcoats, and other articles made in knitting machines, may have greater strength imparted to them, an additional thread layer or carrier is applied at each selvage to a knitting machine, or other provision is made for employing an additional thread at each of the selvages, which thread is laid on to the needles of the machine at and near the selvages together with the thread or threads which is or are laid from selvage needle to selvage needle to produce the main body of the fabric, so that, at and near the selvages, the fabric will be composed of more threads than the intermediate fabric. *Patent completed.*

586. W. Clark. *Improvements in preparing and obtaining photographic impressions, and in the application of such impressions.* (A communication.) Dated March 2, 1863.

Permanent or unchangeable photographic impressions have already been produced by what are termed carbon processes—one of which is based on the employment of matters of a gummy nature, with the addition of a solid bichromate; and the other a mixture of perchloride of iron and tartaric acid, applied only on glass. These processes, which require the employment of negatives, are very expensive and incomplete when acting directly on paper. The improved processes of this invention are based on the application of chemical actions, as applied hitherto, or otherwise, in taking photographic impressions, by means of which the inventor obtains impressions directly on paper—that is to say, he reproduces a positive image from a positive. *Patent abandoned.*

587. T. E. Symonds. *Improvements in the apparatus for steering ships.* Dated March 3, 1863.

This invention relates—1, to a novel mode of constructing and working rudders for steering ships and other vessels, by which additional surface and increase of rudder power can be given when required; and, 2, to the mechanical means employed for transmitting the motion of a steering wheel and the power applied thereto to the rudder of a ship, by which jerking and undue straining are avoided, a superior action of the tackles and intermediate connections effected, the risk of wringing or twisting the rudder head prevented, and by which, also, fewer hands are enabled to steer a ship in the heaviest weather. The invention will be described in a future number of this journal. *Patent completed.*

588. T. Emmott. *Certain improvements in mules for spinning and doubling.* Dated March 3, 1863.

The object of this invention is to prevent snarls, and it consists in certain improved combinations of machinery for governing the rise of the counterfaller, and for putting the strap on to the driving pulley at the commencement of a fresh stretch. In performing this invention, the counterfaller is connected to the strap guide of the driving pulley by means of a sliding bar, or a pulley with a chain and weight or spring, for the purpose of bringing the driving strap at the proper moment on to the driving pulley, thus preventing the yarn from becoming slack, and, consequently, preventing snarls, which are produced when the yarn is allowed to become slack when the carriage is near the drawing rollers. *Patent abandoned.*

589. R. Saunders. *Improvements in metal sheathing for ships and vessels, and in the securing of such sheathing thereto.* Dated March 3, 1863.

The under side of the sheathing, or that intended to be next to the planking or skin of the ship or vessel, is to be made of uneven surface, or ridged, so as to provide at intervals thicker portions to admit of countersinking the heads of the nails or screws necessary for securing the said metal or sheathing to the ship or vessel. And in order the better to secure the sheathing, the inventor screws or nails on strips of metal fore and aft-wise to receive the edges of the sheathing. Between the intervals aforesaid, he fills in thin cork, or any other soft material. By these means he is enabled to produce a uniform outer surface, such as will be conducive to the speed of the ship, besides avoiding the necessity of using so many nails as are at present employed. *Patent abandoned.*

590. G. F. LYSTER. *Improvements in mooring buoys.* Dated March 3, 1863.

This invention consists in constructing mooring buoys in such a manner that, instead of being attached to the mooring chain, and serving as the point of attachment for the vessels, the buoy acts simply as a float or carrier for keeping the end of the mooring chain above water, the latter being in no way attached to the buoy, beyond passing through an aperture formed in the same, and when not attached to a ship's cable, being prevented from falling through the aperture by the larger dimensions of the mooring ring. *Patent completed.*

591. R. H. JONES and J. ABRAHALL. *Improvements in bracelets and brooches.* Dated March 3, 1863.

This invention consists in so constructing bracelets and brooches that the locket, or part carrying the stone or principal ornament, may be reversed without removing the bracelet from the arm or the brooch from the dress. The inventors engage the ends of the locket or frame axis in holes formed in two bars capable of sliding in tubes outside the said ring. The said tubes are at right angles to the plane of the locket. By this arrangement, the locket or frame is capable of being raised above the ring, and the locket or frame may be reversed or swivelled without removing the bracelet from the arm or the brooch from the dress. *Patent abandoned.*

592. G. DAVIES. *Improvements in polishing or giving a lustre to soap, and in the apparatus employed in such process.* (A communication.) Dated March 3, 1863.

The essential feature of this invention consists in the employment of steam, either pure or charged with some perfume, which it takes up on passing through a fabric or fabrics impregnated with perfume or aromatic substances. This steam is brought into contact with the toilet or other soap either before or after moulding, in order to effect the polishing of the surface thereof. *Patent abandoned.*

593. J. HENDERSON. *Improvements in machinery or apparatus for the manufacture of carpets and other piled fabrics.* Dated March 3, 1863.

This invention relates—1, to an improved method of effecting the crossing of the surface warp threads in the manufacture of pile carpets and other piled fabrics, when such pile is formed by the aid of longitudinal lines. For this purpose, the patentee prefers to employ longitudinal wires or instruments of the character of those described in the specification of letters patent granted to himself and Jas. Broadley, bearing date the 3rd day of August, 1861 (No. 1931). These instruments have points or raised portions on them between the end of the batten and the healds when the lathe or batten is in the back. Behind the lathe he applies a comb with long thin flat teeth, and as many of them to the inch as there are longitudinal pile wires. This comb is placed in front of the heald, and immediately behind and close to the joints referred to on the longitudinal pile wires. Each longitudinal pile wire, with its corresponding warp threads, passes between two teeth of this comb, and the teeth are of a length that will admit of their lower ends passing below the lower warps when the shed is open, while, at the same time, the bar in which the teeth are fixed is sufficiently raised above such points on the longitudinal pile wires as to allow of the pile warp threads being elevated to the desired extent above those points. The comb bar is capable of endway motion, in order that, when the pile warp threads are required to pass down on the right side of the wires, the comb may be moved to the right until its thin teeth bend so much as that they slightly pass to the right of the points on the wires, and so as to conduct the pile threads safely and securely past those points; the surface warp heald or harness is now depressed, and the threads are conveyed down the desired side of the wire. If the comb be moved to the left, and the warp threads be depressed, they will, in like manner, be conveyed securely down the left side of the wire. *Patent completed.*

594. G. PRICE and W. DAWES. *Improvements in burglar-proof safes and strong-room doors and frames.* Dated March 3, 1863.

The patentee claims—1, the method or principle of dispensing with the large lock and bolts upon the door, and using in lieu thereof the moveable security portions or "works" in the body or frame of the safe or door, as described; 2, the use, application, and methods of employing hard pig or white pig iron for the purpose of rendering safes and strong-room doors drill proof; 3, the method of protecting the interior of the small lock by electro-coating from the action of acids. *Patent completed.*

595. J. SIBERT. *Improvements in winding and measuring lace.* Dated March 3, 1863.

This invention has for its object improvements in apparatus for winding and measuring lace. The invention is applicable to that class of winding and measuring apparatus known as measuring jennies, wherein the winding is on to forks. For these purposes motion is communicated to the axis of a fork similar in respect to the winding blades or prongs to those ordinarily used, but there are two other prongs at right angles to those on which the winding takes place; these additional prongs are set at a less distance apart than the ordinary ones, and generally somewhat more than half their distance apart. The lace to be wound and measured is conducted over a guide rail, and between two pins or guides, on to the surface of a cylinder, which is hollow and made as light as may be. The periphery or surface of the cylinder is covered with woollen cloth, velvet, vulcanized india rubber, or other suitable holding material. The lace then passes between the surface of the cylinder and a small pressing roller, which is kept pressed up to the cylinder. The lace then descends between two guiding surfaces, between which the lace will not descend without being drawn through, at the same time the two surfaces do not offer such resistance to the passage of the lace as to require any material force to draw it through the space. By this means, if the lace becomes slack between the cylinder and the guides, such slack will not extend to the fork on to which the lace is wound. The rotation of the fork draws the lace through the space between the guides and off the cylinder, by which, when the space of winding is considerable, the cylinder is liable to overrun and produce slack. The two guides are arranged to be readily adjusted to and from the cylinder, and so as to readily admit of their distance from the cylinder being varied. On the axis of the cylinder there is a worm or screw wheel, which takes into and drives a worm or screw wheel which gives motion either to a graduated dial or to a pointer, acting with a fixed graduated dial. *Patent abandoned.*

596. G. LAMB. *Improvements in apparatus for recording the revolutions of the propelling shaft of a steam ship or vessel.* Dated March 3, 1863.

In order to record the number of revolutions of the propelling shaft of a steam ship or vessel, and the time during which the revolutions are made, and whether forward or backward, apparatus is combined and used in the following manner:—A good chronometer or suitable form of time-keeper is arranged to give motion to a strip of paper at a uniform speed, and to mark it at intervals, say, one or more times each minute during which the propelling shaft is in motion. The strip of paper is progressively wound on to an axis as it is delivered from the apparatus, which gives motion thereto, and causes it to pass the marker put into motion by the chronometer or time-keeper as before mentioned. This taking up and winding of the strip of paper may be, by a train of wheels, put in motion by a spring or by other suitable apparatus. The strip of paper before passing to the marking apparatus is wound on to an axis, and sufficient friction is applied to prevent the strip of paper unwinding faster than it is drawn off by the apparatus in connection with the time-keeper. The propelling shaft of the ship or vessel, by means of a projection, gives motion to a marker or marking apparatus at each revolution, so that the strip of paper may be marked each revolution when the vessel or ship is being propelled forward, but such apparatus is arranged not to act or mark when the propeller shaft is rotated in the opposite direction, another marker or marking apparatus being applied, which is acted on only when the propeller shaft is propelling the ship or vessel sternwise. *Patent abandoned.*

597. T. ERICH. *Improvements in machinery for pressing peat.* (A communication). Dated March 3, 1863.

This invention has for its object improvements in machinery for pressing peat. For these purposes two horizontal cylinders or rollers are used, which are geared together by cog-wheels on their axes. The peripheries of these cylinders or rollers are composed of numerous parallel bars placed at short distances apart, so that the water pressed from the peat may pass freely between the bars into the interior of the cylinders or rollers; it is received into suitable gutters, and conducted thereby out of the cylinders or rollers. The sides of the bars are not radial from the centres of the cylinders, but incline downwards to give freer passage to the water. Two strong endless fabrics are employed, one to each of the cylinders, and to the selvage of these fabrics are fixed strong cords, by which and by guide pulleys the fabrics are held extended as they are caused to circulate by the motion of the two cylinders or rollers. On the outer side of one of the endless fabrics parallel transverse ridges of wood or other suitable material are fixed, by these the surface of the endless fabric is divided into parallel hollow spaces, which are further enclosed at their ends by means of flexible ridges of leather, or other suitable material, placed parallel with the selvages of the fabric, and near thereto. The transverse ridges extend up to, but not beyond, the ridges which are parallel with the selvages. The peat is placed in a hopper, the lower end or outlet of which comes between the two fabrics where they meet, and descends between the pressing cylinders or rollers, and the ledges on the one endless fabric assist in carrying down the peat between the cylinders or rollers. By these means the peat is pressed into a sheet having transverse indentations on one side. The sheet of compressed peat, on leaving the fabric, is conducted to circular saws or cutters which cut the sheet longitudinally. The endless fabrics are cleansed by means of jets of water, which are capable of being moved to and fro across the surfaces of the two fabrics. *Patent abandoned.*

598. D. B. PARSONS. *Improvements in reaping and mowing machines.* (A communication.) Dated March 3, 1863.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

599. B. S. COHEN. *Improvements in apparatus for protecting the points of pencils.* Dated March 3, 1863.

In order to protect the points of pencils where the lead or other marking material is enclosed in wood, and where the points are formed by cutting away the wood, a sliding elastic tube (by preference of metal) is applied. This tube is split longitudinally, and has a tendency to close on and embrace the pencil with an elastic holding, so as not readily to be moved along the pencil when out of use and in the pocket. In addition to the tube embracing the pencil by its elasticity, there is an internal spring (or springs) which rests against the conical or inclined shoulder, which is formed by the cutting away one end of the pencil; hence when the pencil is out of use, and the guard tube has been slid over the point thereof, this spring, or these springs, will press on such conical end or shoulder, and prevent the tubular guard being forced back along the pencil. *Patent completed.*

600. W. PARSONS. *Improvements in dining tables.* Dated March 3, 1863.

This invention consists in the application of certain apparatus for extending and contracting the framework of such tables for the purpose of enlarging or reducing their size. The inventor employs for this purpose a system of cross levers such as are usually denominated lazy tongs, the one end of such system of levers being connected with the one end of the table, and the other with the other end. For ordinary or small-sized tables he prefers to fix the pivot of the first pair of cross levers to the table; and to the extreme end of such first pair of levers he applies a nut in which a screw works; this screw is of some 8 or 10 in. in length, and rotates in the end frame of the table, where it is held and prevented from moving in the direction of its length by suitable collars. This screw is turned by a suitable key, and the action on the nut causes the cross levers to extend or collapse, and with them the table to extend or contract. *Patent abandoned.*

601. J. POLLARD. *Improvements in warp dressing, and in apparatus connected therewith.* (A communication.) Dated March 3, 1683.

This invention consists in the combination of warp dressing apparatus hereinafter described with the loom used for weaving fabrics, in such a manner that the processes of weaving and dressing the warp being so woven are effected simultaneously. For this purpose the inventor causes the threads (after passing over what is ordinarily termed the warp beam), guided by a reed, to pass between two rollers, the lower roller being covered with flannel, or other similar material, and partially immersed in a suitable trough or vessel containing the size and dressing in the direction of the healds of the loom, the threads of the warp being kept even and in sufficient tension by means of two small rods (over and under which they are crossed alternately) affixed to an adjustable bar attached to the loom for that purpose. Or the threads may be caused to pass over the upper one of the rollers before alluded to, and which, in this case, would be covered with flannel, or other suitable material, and receives the size or dressing from the lower roller revolving in a trough, and not necessarily covered with flannel or similar material. To the ordinary crank-shaft of the loom is attached a brush or brushes of suitable breadth to remove any superfluous size from the warp threads as they pass over that part of the loom where the shaft is placed, the revolving-brush being cleansed in turn by contact with a brush fixed to the trough or any convenient part of the loom. A fan may be attached to the crank-shaft to partially dry the warp threads; but this he does not insist on, as experience has proved it not essential. The component parts of the above described warp dressing apparatus are fixed by preference in the framework of the loom, forming with the loom a combined apparatus for dressing warps and weaving fabrics simultaneously. *Patent completed.*

602. C. M. PALMER and J. MCINTYRE. *An improved mode of applying and fastening metal sheathing to the bottom of iron ships or vessels, and to iron for other uses.* Dated March 4, 1863.

This invention consists in fixing to the iron plates of the ship or vessel, or to iron for other similar uses, strips of metal, which the patentees prefer to be of galvanized iron, in which strips are inserted rivets of copper or other suitable soft metal, such rivets protruding from the strips in such a manner as to admit of strips of copper, "Muntz metal," zinc, or other sheathing previously punched, being applied thereto, and held thereby as required. By this arrangement the strips fixed to the vessel form carriers for the sheathing, and obviate the necessity of perforating through the ship's side. The strips are double—that is to say, there is one outer and one inner strip, and they are applied to the plates of the vessel by means of screws or rivets passing through both strips, and into the said plates, the copper rivets having been previously inserted in an opposite direction in the outer strip. The sheets of copper, Muntz metal, zinc, or other sheathing, are put on to the projecting copper rivets with their edges overlapping, so that the ends of two sheets are held by one row of rivets, and tarred felt, blair, or other similar non-conducting material is inserted between the iron plates of the vessel and the copper or other metal sheathing. The projecting portions of copper are then hammered so as to securely rivet them. *Patent completed.*

603. J. F. GITS. *An improved furnace for the revivification of animal charcoal.* Dated March 4, 1835.

This invention is not described apart from the drawings. *Patent completed.*

604. A. P. JEUNE. *Improvements in spring bed bottoms.* Dated March 4, 1863.

Provisional protection has not been granted for this invention.

605. J. DE KEYSER. *Improvements in treating petroleum oil and in the combination thereof with other oils for lubricating and other like purposes.* Dated March 4, 1863.

This invention consists in subjecting petroleum oil to one or more distillations, so as to clear it from impure and tarish matters, using soda to clear it from acids, and thus to render the oil so purified capable of being combined with the oils of fish, animals, grains, or other substances. *Patent abandoned.*

606. T. H. MORRELL and J. WILLIAMSON. *A new or improved method of purifying the noxious vapours or gases given off from night soil, or other similar substances, during the heating, drying, or evaporating of such substances.* Dated March 4, 1863.

This invention consists in drawing or forcing, or in drawing and forcing, the noxious vapours or gases given off from night soil, or other similar substances, during their heating, drying, or evaporation, or of otherwise conducting or passing such vapours or gases into or through chloride of lime, or any other similar purifying chemicals or purifying agents, strewed upon a series of perforated plates or bars, placed in the draught, or otherwise, in conjunction or connection with the oven or apparatus that may be used for evaporating the night soil or other similar substance. By these means night soil, or other such similar substances, may be readily prepared for use as a manure for agricultural purposes. *Patent completed.*

607. E. A. WUNSCH. *Improvements in treating sea-weed, and in apparatus therefor.* Dated March 4, 1863.

By the present invention, the sea-weed itself is made to supply a large portion of the heat required for the drying operation. For this purpose the patentee adopts furnace arrangements somewhat similar to what have been proposed

for burning "begasse," and other kinds of wet fuel. The invention cannot be described without reference to the drawings. *Patent completed.*

608. P. Adie. *Improvements in means and apparatus for measuring angular and actual distances.* Dated March 4, 1863.

These improvements relate to the arranging of the instruments patented by the present patentee 10th February (No. 357), 1860, in such a way as to get rid of the errors of eccentric and other parallax. For this purpose, in the first arrangement applied to measuring angular distances, he adopts two similar telescope object ends, one above the limb and the other below, the lower one being fixed to the limb, and the upper one with a vernier attached reading full degrees, and travelling over the length of the arc. To connect these the upper telescope has a hollow male centre at right angles to and in one piece with itself, and the lower one a female centre, also in one piece with and at right angles to the lower telescope. At the junctions of the male and female centres and their respective telescope tubes is placed a reflecting prism or other reflector in each, which sends the rays received from their respective object glasses through the hollow centre and towards each other; these rays are then received on two smaller reflectors mounted on an adjustable arm to correct for eccentricity and parallelism, each reflector occupying half the field of the eye-glass which then receives the rays. A position is given to the eye piece always intermediate to the angle of the two telescopes by means of two levers, each attached at one end to the object ends of the telescopes, and at the other end to a sliding piece on the eye tube, and turns on a centre round the outside of the female or lower telescope centre, and to this the interior or half prisms are attached with their adjustments. By this means, having the two telescopes and their reflectors symmetrical, he gets rid of all parallax, and gets parallel rays into the eye piece. The improvements may be applied, also, when only plain sights are used. He also adapts a small reflector, fixed to the eye tube centre, and brought by an arm over the centre of the instrument; this he uses as a finder and as a quick measurer of the angle, both arrangements reading in full degrees on the limb. The improvements relate—2, to the arranging of the reflectors in the second part of the invention, when the actual distance of an object is measured by the angle formed by the cones of rays of the two telescopes, so as to get rid of parallax, and bring the rays from both object-glasses parallel into one eye piece. For this purpose he attaches the object-glass of the moveable telescope, and the reflector behind it, to the inner tube, at the end farthest from the centre, the reflector behind the other object-glass, and the object-glass itself, being made a fixture to the outer tube. The centre round which the interior telescope turns he places near or in the middle of the instrument. The rays from both object-glasses, passed towards the centre by the above reflectors, are then received by two half reflectors, either one before the other, or their ends opposite to one another, when used in a hollow centre. For facilitating the fixing and adjustment of these prisms, he attaches the front one to the outside of the outer tube; or, if both are used in a hollow centre, he fixes both from the outside. *Patent completed.*

609. E. W. Binney. *Improvements in pressure and pump lamps.* (A communication.) March 4, 1863.

Provisional protection has not been granted for this invention.

610. E. W. Binney. *An improved lamp burner.* (A communication.) Dated March 4, 1863.

This invention relates to an improvement in attaching the cone or deflector to the burner of a lamp by means of a pivot, so as to allow the cone or deflector to work freely on this pivot in a horizontal direction, whereby the cone or deflector and draft chimney may be readily turned aside, or off from the burner, so as to expose the wick tube, and thereby render the wick accessible for trimming and lighting. *Patent abandoned.*

611. W. Clark. *Improvements in the manufactnre of sulphuric acid, and in apparatus for the same.* (A communication.) Dated March 4, 1863.

According to this invention, the inventor dispenses entirely with the use of leaden vessels in the manufacture of sulphuric acid. Although he dispenses with lead chambers, this improved apparatus presents a large surface to the gas, and so permits of its action on one and the other with the same facility as with lead chambers. These improvements are based on the principle that the combination of gases or vapours may be easily effected under the influence and through the intermediation of porous bodies. The substance employed for multiplying the points of contact of the gas, and presenting a large surface by its porosity in a small volume, consists of coke, which is well washed and calcined, the apparatus being formed of earthenware, and of peculiar form. The production of the sulphuric acid is effected in the ordinary manner—that is to say, by the combustion either of sulphur or of iron or copper pyrites. The invention cannot be described without reference to the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 5, 1863.

1401. A. Q. de Gromard, Paris, gentleman. Improvements in musical instruments.

Dated June 25, 1863.

1605. H. C. Lee, Lawrence Pountney-lane, merchant. Improvements in the construction of sewing machines. (A communication.)

Dated August 4, 1863.

1924. E. A. Cotelle, 29, Boulevart St. Martin, Paris, distiller. A new method of manufacturing gas alcohol by means of diluted acids acting indefinitely without reconcentration.

Dated August 12, 1863.

1989. L. R. Bodmer, 2, Thavies'-inn. An improved mode, and apparatus for, dressing and finishing and for imparting lustre to yarn and thread made of silk, cotton, and other fibrous substances. (A communication.)

1995. R. S. Newall, Gateshead. Improvements in apparatus for serving ropes for ships' rigging and other purposes.

Dated August 13, 1863.

1998. C. C. Dennett, Nottingham, builder. An improved method of fire-proof construction for buildings by the use of arches formed of concrete.

Dated August 15, 1863.

2030. J. Grantham, 31, Nicholas-lane, civil engineer. Improvements in apparatus for manufacturing salt.

Dated August 24, 1863.

2091. H. Batt, 21, Charlton, King's-road, Kentish-town. Improvements in roughing horses without taking off the shoe.

2096. F. R. Stack, Belgrave-villa, Finchley. Improvements in the construction of military bridges, piers, landing stages, and escalading apparatus.

Dated August 27, 1863.

2121. G. Richards, 2, Caroline-street, Bedford-square, esquire. Improvements in the construction of ordnance and firearms, and in the projectiles to be used therewith.

Dated August 28, 1863.

2127. L. A. Mulet, Rue St. Charles, No. 1, Thernes, Paris, merchant. An improved method of shoeing horses, and covering the feet or hoofs of other domestic animals with hardened india rubber, gutta percha, and other improved similar materials.

Dated August 29, 1863.

2137. W. Whitworth, engineer, and J. Wrigley, Sowerby Bridge, near Halifax. Improvements in, or applicable to, the furnaces of steam boilers.

Dated September 2, 1863.

2169. R. Sims, Bedford Foundry, Leigh, agricultural implement maker and iron founders. Improvement in reaping and mowing machines.

Dated September 3, 1863.

2174. A. L. Durand, 10, Rue de la Fidélité, Paris, merchant. Certain improvements in the manufacture of nails and other similar articles.

Dated September 4, 1863.

2183. C. Thornhill, Sheffield, merchant. A new or improved method of adapting steel or other suitable metallic wire to be used instead of animal bristles or hair, in sewing boots, shoes, saddlery, and leather works generally.

2184. C. G. Kelvey, Rock Ferry, Chester, watch manufacturer, and W. Holland, manager. Improvements in the construction of chronometers and other time-keepers.

2185. J. Hendry and W. Coutts, Aberdeen, merchants. Improvements in furnaces.

Dated September 7, 1863.

2198. J. B. York, Coleshill, gentleman. Improvements in privies or closets to be used in place of water-closets.

Dated September 8, 1863.

2211. J. D. Jack, Montrose, engineer. Improvements in moulding or shaping metals.

Dated September 9, 1863.

2214. J. Lille, civil engineer, and J. H. White, dentist, Manchester. An improved composition or coating for the protection and preservation of surfaces of iron, wood, and other materials.

2215. W. H. Hawksworth, Oldham, machinist. Certain improvements in apparatus for preparing cotton and other fibrous materials for spinning.

Dated September 10, 1863.

2229. J. H. Wilson, Liverpool, brass founder and ships' ironmonger. Improvements in side-lights for ships and other navigable vessels, and in the manufacture of the same.

Dated September 14, 1863.

2253. H. Riviere, 19, Queen's-road, Bayswater, gun maker. Improvements in the construction and application of apparatus and implements used for the purposes of heating, cooling, and evaporating.

2256. W. E. Gedge, 11, Wellington-street, Strand. Improvements in safety lamps for mines. (A communication.)

Dated September 16, 1863.

2264. J. Fox, Derby, engineer. Improvements in machinery for planing or cutting off the sides of armour plates.

2265. A. Fleming, Glasgow, mat maker. Improvements in cutting or finishing matting and similar fabrics, and in the machinery used therefor.

2266. G. Lewal, 5 and 6, Philpot-lane, engineer. An improved method of, and apparatus for, consuming smoke and heating and warming public and other buildings, and for drying purposes generally.

Dated September 17, 1863.

2277. J. McEwen, Lay's Foundry, near Brierly-hill, iron founder and coke manufacturer. A new or improved combined coke oven and hot blast oven or apparatus.

2278. Z. J. Mercier, 50, Rue de Longchamp, Chaillot, Paris, mechanician. An improved gas cock of elastic and continuous pressure.

2279. W. E. Gedge, 11, Wellington-street, Strand. Improved instruments for ascertaining levels, also for computing angles. (A communication.)

2281. A. Chaplin, 24, Cheyne-walk, Chelsea, engineer. Improvements in apparatus for propelling ships or vessels.

2282. P. Cowan, Barnes, manufacturer. An improvement in refining sugar.

2283. F. de Wyldé, Trinity-square, Tower-hill, gentleman. Improvements in the manufacture of an hydrated silica.

2284. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in taps. (A communication.)

2286. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in life belts and swimming belts. (A communication.)

2287. P. McLaurin, Glasgow, manufacturer. Improvements in drying paper, pasteboard, and similar fabrics, and in the machinery, apparatus, or means employed therein.

2289. J. Whitehead, Calverley, near Leeds, mechanic. Improvements in pneumatic motive power machinery.

Dated September 18, 1863.

2290. J. Allen, Manchester, engineer and brass founder. Improvements in the construction of valves and cocks for steam, water, gas, and other fluids.

2291. J. Roberts, Manchester, organ builder, and R. Naylor, gentleman. Improvements in increasing, diminishing, or otherwise regulating the power and tone of organs, harmoniums, pianofortes, or other instruments with similar keys or keyboards.

2292. R. D. Dwyer, Warrington, engineer. Improved apparatus for cleaning and painting or coating the bottoms of ships and other structures.

2293. G. Davies, 1, Serle-street, Lincoln's-inn, civil engineer. Improvements in the manufacture of iron and steel, and in apparatus to be employed in such manufacture. (A communication.)

2294. W. Lorberg, Wyld's-rents, Bermondsey, analytical chemist. Improvements in the treatment of rags, and obtaining valuable chemical products from the animal fibre therein.

2295. I. Baggs, Cambridge-terrace, electrician. Improvements in the means of protecting and preserving the hulls and bottoms of ships and vessels from fouling and corrosion.

2296. A. Noirot, 61, Rue Pigaile, Paris. New tiles.

2297. J. M. Cook, Leicester, hay and corn factor. Improvements in railway carriages and all other springed vehicles.

2298. R. A. Brooman, 166, Fleet-street, patent agent. An improved thread for fishing nets. (A communication.)

2299. H. W. Hart, Fleet-street, manufacturer. An improvement in T-fastenings.

2301. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improvement in propelling vessels, and in apparatus relating thereto. (A communication.)

2302. W. Smith, 19, Salisbury-street, Strand, civil engineer. Improvements in constructing breech-loading ordnance. (A communication.)

2303. W. Smith, 19, Salisbury-street, Strand, civil engineer. Improvements in the construction and mode of working ordnance for ships and forts, and in the means of protecting those engaged in working guns employed for such purposes. (A communication.)

2304. T. Small, Bargate, Boston, Lincolnshire. Improvements in motive-power machinery.

2305. V. Houghton, Grove-house, West Reading. Improvements in lamp and lamp wicks. (A communication.)

Dated September 19, 1863.

2307. J. Buckley, Lees, Yorkshire, manager. Certain improvements in mules for spinning cotton and other fibrous substances.

2309. R. Couchman, Noble-street, St. Martin's-le-Grand, manufacturer. Improvements in articles or instruments for supporting, holding, or carrying parasols, bags, watches, ornaments, or other articles or appendages.

2310. C. L. Fleischmann, 18, Rue Moncey, Paris. Improvements in machinery or apparatus for ginning cotton, also for cleaning, opening, and preparing cotton, wool, or other fibrous substances.

2311. B. Davis, Brettle-lane, Stafford, millwright, and W. Bowler, Wall-heath, Stafford, ironfounder. An improved mode of strengthening tilt hammers.

2312. J. C. Pooley, George-street, Bath, Somersetshire, chemist. Improvements in brewing or preparing beverages from malt and hops.

2313. J. P. B. Le Paturel, Piette-house, Guernsey. Improvements in breech-loading firearms.

2315. T. Richardson, Newcastle-upon-Tyne, chemist, J. Lundy, Leith, colour manufacturer, and R. Irvine, Magdalen Chemical Works, manufacturing chemist. Improvements in the extraction or manufacture of oils from vegetable substances.

2316. H. Bateman, Castlenau, Barnes, surveyor. An improved construction of rotary engine.

2317. T. E. Vickers, Sheffield, steel manufacturer. An improvement in the manufacture of cast-steel tyres. (A communication.)

Dated September 21, 1863.

2319. E. F. Battier, 82, Boulevart Sebastopol, Paris. Improvements in crinolines.

2321. W. B. Robins, Harborne, Staffordshire, actuary. Improvements in portable fire and garden engines.

2322. A. A. Downes, Stonnall, Staffordshire, spinster. Improvements in artificial teeth.

2323. E. Alcan, King-street, merchant. Improvements in shears for cutting metal threads, wires, and rods, applicable also for gauging wires. (A communication.)

2324. E. Alcan, King-street, merchant. Improvements in condensers, applicable to wool carding engines. (A communication.)

2325. F. A. Chåtel, 29, Boulevart St. Martin, Paris, manufacturer. Improvements in burners for burning all mineral oils. (Partly a communication.)

2326. R. Wallis, Basingstoke, Hants, corn and coal merchant. Improvements in apparatus for loading and unloading vessels, and raising, lowering, and otherwise conveying sacks, casks, agricultural produce, and other objects from one locality to another.

2327. R. Ridley, Leeds, and J. G. Jones, Cumming-street, Pentonville. Improvements in apparatus for giving a reciprocating motion to picks and cutting tools used in getting coal and other minerals and stone.

2328. G. T. Bousfield, Loughborough Park, Brixton. Improvements in power looms for weaving hair cloth and fabrics in which the weft is inserted in separate lengths of material. (A communication.)

2330. W. Hutchinson, 26, Rue Notre Dame des Victoires, Paris, manufacturer. Improvements in machinery for manufacturing moulded articles of india rubber. (A communication.)

2331. T. B. Daft, Harlesden. Improvements in the construction of ships and vessels, and in sheathing the same.

2332. W. A. Von Kanig, Bedford-place, Russell-square. Improvements in railway telegraphs and signals, and also in the permanent way and carriages, for preventing railway accidents.

Dated September 22, 1863.

2333. J. Renshaw and J. Haworth, Manchester, machinists. Improvements in machinery for stretching woven fabrics.

2335. P. Effertz, Manchester, engineer. Improvements in machinery or apparatus for making bricks, tiles, pipes, and other similar articles.

2336. C. Maitland, Alloa, brewer. Improvements in mashing apparatus.

2337. J. and J. Bond, Longridge, near Preston, machinists. Improvements in brick and tile-making machinery, applicable also to machinery for manufacturing other articles from plastic materials.

2339. J. Brigham and R. Bickerton, Berwick-on-Tweed, implement makers. Improvements in reaping or mowing machines.

Dated September 23, 1863.

2340. W. Clenimson, Ashton-under-Lyne, gas fitter. Improvements in the construction of pipe wrenches.

2341. J. Platt, 33, Argyle-street, St. Pancras, engineer. Improvements in machinery applicable to steam and water engines (as motors), which machinery is also applicable to lift and force pumps.

2343. W. and J. Galloway, Manchester, engineers. Improvements in lubricating journals of revolving shafts and axles, and in the apparatus employed for that purpose.

2344. E. T. Hughes, 123, Chancery-lane. Improvements in gas condensers. (A communication.)

2345. W. Gibb, spinner and manufacturer, and J. Holland, manager, Eccles, Lancashire. Improvements in looms for weaving.

2346. W. T. Eley, Gray's-inn-road. Improvements in the manufacture or construction of ball cartridges.

2347. A. Collingridge, 82, Cheapside. Improvements in the manufacture of casks and other receptacles for containing oil, petroleum, and other liquids.

2348. J. Phillips, Tollington-road, Holloway, civil engineer. Improvements in the construction of levels, applicable to levelling, surveying, astronomical, nautical, and other instruments or purposes to which levels are applicable.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, October 6, 1863.

1279. J. Fawcett. Preparation of food for cattle, horses, and other animals.

1287. G. Stevens. Coke ovens.

1300. F. Potts and J. Key. Manufacture of iron tubing.

1304. F. Kingsbury. Construction of orchestras.

1312. G. Köttgen. Improved binding.

1321. A. Haley. Jacquard looms.

1325. J. Buckingham. Ploughs.

1330. A. Bastow. Looms for weaving.

1331. H. C. Coulthard. Blast engines.

1332. H. J. Kennard. Wrought-iron cylinders.

1333. C. Gammon. Spring fastening.

1334. W. Palliser. Projectiles for ordnance.

1336. W. I. Ellis. Steam boilers.

1342. T. Richardson and R. Irvine. Preparation of Esparto grass.

1346. R. A. Brooman. Paddle wheels. (A communication.)

1347. W. Needham and J. Kite. Expressing liquid and moisture.

1351. J. J. Potel. Accelerating the draft in furnaces and fire-places.

1356. F. Patureau. Cardboard or paper boxes or receptacles.

1366. F. W. Smith. Conveying goods either in bulk or otherwise.

1377. G. A. and A. Barrett, W. Exall, and C. J. Andrewes. Regulating the speed of steam engines. (Partly a communication.)

1387. G. Davies. "Ginning" cotton. (A communication.)

1403. T. Gray. Treating substances.

1415. W. Clark. Mounting and fitting bedsteads, chairs, and other moveable seats on board ship. (A communication.)

1422. R. C. Furley. Preparation of castor and other oils for medicinal use.

1423. H. Reynell. Manufacture (by the introduction of cocoa-nut husk or part thereof) of a substitute for ordinary felt and kamptulicon.

1426. J. Petrie. Washing wool.

1431. C. Nicquet. Sorting and washing ores.

1499. W. Clark. Engines for obtaining motive power from steam or other liquid. (A communication.)

1522. A Samuelson. Evaporating liquids.

1568. W. Toovey. Photo-lithography, photo-zincography, and photographic engraving.

1597. A. Ripley. Method and construction of a packing chiefly applicable to piston rods, pumps, and such like, and forming the joints of gas, steam, or water pipes.

1762. W. Wood. "Warping" or covering land, bog, or peat, with earth or soil.

1824. C. S. Duncan. Means of, and apparatus for, heating, melting, boiling, evaporating, and other useful purposes.

1880. H. A. Bonneville. Self-acting flushing apparatus. (A communication.)

1923. J. H. Walsh. Breech-loading firearms.

1998. C. C. Dennett. Fire-proof construction for buildings.

2014. H. H. Lishman. Punching and marking plates in which holes are to be punched.

2142. A. Rowand. Evaporating fluid solutions.

2188. G. Hargreaves. Steam boilers.

2337. J. and J. Bond. Brick and tile making machinery.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed October 2, 1863.

864. F. C. Bakewell.
865. B. Cooper.
870. J. Burwin.
872. J. Swinburne and J. Stanley.
874. A. C. Bamlett.
878. R. A. Brooman.
879. R. A. Brooman.
889. W. H. Mitchel.
890. J. L. Norton.
891. A. Kinder.
896. G. Spencer.
907. T. Baldwin.
908. S. Shelmerdine and J. Dransfield.
910. R. Smith.
916. J. Lockwood.
923. C. A. Collins.
925. J. Gill.
927. R. Leggett and R. Gittus.
942. J. Smith.
947. H. A. Bonneville.
948. A. Marriott.
953. T. B. E. Fletcher.
995. W. C. Cambridge.
1011. W. Clark.
1013. P. McGregor.
1034. J. Dunbar, jun., and J. W. Woodford.
1036. A. Poirrier and C. Chappat.
1042. W. E. Newton.
1070. R. Butterworth.
1072. G. E. Donisthorpe.
1073. H. Y. D. Scott.
1085. H. W. Ripley.
1086. M. Henry.
1234. V. J. Cassaignes.
1264. P. Addington.
1425. W. E. Newton.
1454. C. L. Van Tenac.
1464. W. Sims.
1543. T. Smith, T. Moore, and M. Burrell.
1613. R. Mushet.
1701. G. Haseltine.
1748. J. Laing.
1846. M. Meisel.
1980. A. V. Newton.
1987. R. Mushet.
1988. J. Cornforth and A. Andrews.
2034. G. T. Bousfield.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2370. C. H. Hurst, H. Horsey, and G. Baker.
2384. G. Rhodes and J. Syme.
2390. J. and D. F. Bower.
2397. J. W. Greaves.
2398. W. E. Newton.
2411. W. MacNaught.
2425. W. Yates.
2438. J. Calkin.
2469. G. T. Bousfield.
2935. J. A. Fanshawe and J. A. Jacques.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2320. D. O. Boyd.
2476. W. E. Newton.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending October 3, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
432	0 8	439	0 4	446	1 2	453	0 4	459	1 6	465	0 4
433	0 4	440	0 4	447	0 8	454	0 8	460	0 4	466	0 8
434	0 4	441	0 4	448	0 10	455	0 4	461	0 6	467	0 6
435	0 4	442	0 8	449	0 8	456	0 10	462	0 8	468	1 0
436	0 4	443	1 6	450	0 4	457	0 4	463	0 8	469	0 4
437	0 6	444	0 4	451	0 4	458	0 8	464	1 0	470	0 4
438	0 8	445	0 4	452	0 10						

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£ s. d.		£ s. d.	p ct
Iron:—					
Welsh Bars, in London	per ton	7 10 0	to	0 0 0	2½
Nail Rods	do	8 0 0		8 10 0	
Hoops	do	10 10 0		0 0 0	
Sheets, single	do	11 0 0		0 0 0	
Staffordshire Bars	do	9 10 0		0 0 0	
Bars, in Wales	do	6 10 0		6 15 0	
Rails	do	6 15 0		0 0 0	nett
Foundry Pigs, at Glasg, No 1	do	3 0 0		3 7 0	
Swedish Bars	do	11 10 0		12 10 0	2½
Steel:—					
Swedish Keg, hammered	do	16 0 0		16 10 0	
Swedish Faggot	do	17 0 0		18 0 0	
Copper:—					
Sheet & Sheathing, & Bolts	do	102 0 0		0 0 0	3
Hammered Bottoms	do	112 0 0		0 0 0	
Flat Bottoms, not Hamrd	do	107 0 0		0 0 0	
Tough Cake and Ingot	do	95 0 0		0 0 0	
Tile Copper	do	98 0 0		0 0 0	
Best Selected	do	98 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½		0 0 8¾	
Fine Foreign	per ton	98 0 0		100 0 0	
Tin:—					
English Block	per cwt.	5 15 0		0 0 0	2½
do Bar	do	5 16 0		0 0 0	
do Refined	do	6 0 0		0 0 0	
Banca	do	6 2 0		6 3 0	nett
Straits	do	5 16 0		5 17 0	
Tin Plates:—					
Best Charcoal, I.C.	per box	1 8 6		1 9 6	
Second Quality	do	1 7 0		1 7 6	
Coke	do	1 3 6		1 4 6	
Lead:—					
Pig, English	per ton	21 7 6		21 10 0	2½
„ Spanish Soft	do	19 7 6		19 10 0	
Shot, Patent	do	23 10 0		0 0 0	
Sheet	do	21 0 0		0 0 0	
White	do	27 0 0		27 10 0	
Spelter:—					
On the spot	do	18 10 0		0 0 0	nett
Zinc:—					
English Sheet	do	24 0 0		24 0 0	2½
Quicksilver	per btl.	7 0 0		0 0 0	3
Regulus of Antimony:—					
French star	per ton	38 0 0		0 0 0	

Timber, duty 1s. per load, drawback 1s.

	£ s.	£ s.
Teak, load	£12 0	£13 0
Quebec, red pine	3 10	4 10
„ yellow pine	3 10	4 10
St. John, N.B., yellow	0 0	0 0
Quebec oak, white	5 10	6 10
„ birch	3 10	4 10
„ elm	3 10	5 0
Dantzic oak	3 10	6 10
„ fir	2 10	3 10
Memel fir	3 5	3 10
Riga	3 0	3 5
Swedish	2 10	2 15
Masts, Quebec red pine	5 0	6 0
„ yellow pine	5 0	6 0
Lathwood, Dantzic, fm	5 10	6 10
„ St. Petersburg	8 0	8 10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.		
Quebec, white spruce	16 10	18 10
St. John, white spruce	14 0	15 10
Yellow pine, per reduced C.		
Canada, 1st qual.	17 0	18 0
„ 2nd do.	11 0	12 0
Archangel, yellow	£13 0	13 10
St. Petersburgh, yel.	11 10	12 0
Finlan	9 0	10 0
Memel	10 0	15 0
Gothenburg, yellow	10 0	11 0
„ white	9 0	9 10
Gefle, yellow	10 10	11 10
Soderhamn	9 10	10 10
Christiania, per C., 12ft. by 3 by 9 in.		
Christiania, yellow	21 0	23 0
Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 0
Pumice Stone pr ton	5 10	8 0
Oils, &c.		
Seal, pale ... per tun	45 0	0 0
Sperm body	80 0	0 0
Cod	55 10	0 0
Whale, Sth Sea, pale	43 0	44 0
Olive, Gallipoli	60 0	0 0
Cocoanut, Cochin	46 0	47 0
Palm, fine	37 10	38 0
Linseed	42 10	0 0
Rapeseed Eng. pale	43 10	44 0
Cottonseed	32 0	33 0

FRENCH & SMITH, Sworn Brokers, 4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number:—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 16, 1863.

STEAM SHIP ECONOMY.

Few steam ships can carry coals sufficient for more than a ten days' trip; and the fact certainly does not strengthen a belief in the engineering progress of the twenty years or so which have elapsed since the steam engine was fairly set afloat on a commercial footing. The "British Queen" or the "Great Western" could have kept the sea for as long a period as most of the steam ships, of a similar size and class, built recently; and, with all our boasted finish and workmanship, it is doubtful if the marine engines of the present day answer their purpose a whit better than those constructed during the noviciate of firms which have now attained to very high positions. One unfamiliar with the past history of the steam engine, made acquainted for the first time with the fact contained in the first lines of this article, would naturally ask in what respect are the engines of our Navy or our mercantile fleets, superior to those built the fourth part of a century since? Truth answers, in nothing save a slight reduction in size and weight. A little less money is expended in repairs, the consumption of oil and tallow is perhaps reduced, the weights and strains of the engines, are better distributed through the hull and ship, and machinery possibly lasts a little longer; but these are trifling considerations in the face of an increased first-cost, and a consumption of fuel at least twice as great as it should be; all the skill and energy of the period which has elapsed since the "Royal William" first demonstrated the practicability of voyage under steam across the Atlantic, having failed to reduce it by much more than a pound or two per horse-power per hour. The explanation of all this is very simple, and possibly from that reason very much overlooked. The principles involved in the working operations of the modern engine are precisely the same as those which gave vitatity, so to speak, to its predecessor. Changes in form are met with ordinarily enough; but the economy of fuel depends very slightly, if at all, on shape or its varieties, so long as there is no grievous departure from those forms which practice has proved moderately correct. The same quantities of fuel will give like results, whether the steam is worked in a vertical, horizontal, or oscillating cylinder. It is not in principles of construction, but in those of working, that radical changes are necessary, before we can hope for well-defined improvement.

The coal bill of our Navy is a serious item in the national expenditure—one so serious, indeed, that those who pay it are entitled to demand its reduction to the lowest possible limit which the legitimate service of the State will permit. Still, while we see a reckless expenditure adhered to by private steam ship companies, it may be urged that it is unfair to expect that Government should bestir itself very vigorously to bring about a reduction in the rate of exhaustion of our coal fields. Reflexion will show, however, that this argument is of little weight, inasmuch as all the large steam companies virtually have the greater proportion, if not the entire amount, of their expenditure for coals repaid by Government subsidy, without which they could not exist as corporate bodies; and it is a highly suggestive fact, that to single ships, belonging to private individuals or firms, we can alone look for the realization of any economical results. Many such vessels are paying their way well—in the Mediterranean, for example—with a consumption of not over $2\frac{1}{2}$ lbs. of coal per indicated horse-power per hour. Competition is so powerful, that a very slight increase in the working expenses of a steam ship line, may render that which would otherwise be a successful commercial undertaking, an utter failure. We do not dispute that those mechanical expedients, which prove useful to non-subsidized lines, are equally applicable to those which must rely on their own resources. The most influential steam companies have, however, hitherto refused to adopt them, principally because they are content with the results achieved, and do not care to risk their subsidy by the chance of breaking their contract by the failure of engines embracing novelties. Thus, the "Scotia" is fitted with engines which would half ruin a company not receiving Government aid. Subsidies cover a multitude of engineering sins; and we feel little doubt that, had they never existed as an institution, marine engineering would be much further advanced than it is.

It is urged that marine engines which are economical in the consumption of fuel, are complicated, and liable to get out of order, requiring the expenditure of much money on repairs. We confess we are unable to see the cogency of this style of argument. The wear and tear of boilers must naturally depend almost altogether on the quantity of fuel burned in them, and the conditions regulating its combustion. If one steam ship requires four boilers to perform the work accomplished by another with two, it is easy to see that, the same rate of combustion being observed on the grates, the boiler expenses must be just twice as great in the former as in the latter case; while the engines, if constructed on correct principles, cannot suffer more in one case then the other, provided the same amount of work is developed in their cylinders, and transmitted through the parts in motion. Certain forms of engine and boiler have been proposed and patented, made and set to work, in which everything was sacrificed to high pressure. The result has been failure, as might reasonably have been expected. Much injury has been done to the science of marine engineering by rash impetuosity; but it speaks poorly for our constructive enterprise, if a few such failures should prove more effectual in staying our onward progress, than a hundred successes in hastening it.

It is much to be deplored that the advocates of steam ship economy should have insisted so strenuously on the employment of excessive pressures. Theoretically right, these gentlemen have failed to see that the means essential to the carrying out of their principles, were practically wrong under the exigencies of maritime service. The ordinary type of marine boiler is quite unfit for carrying anything like high steam; yet its external form is dictated by the shape of the space devoted to it within the hull. Long experience has proved such boilers to be perfectly trustworthy up to pressures of 25 lbs. to the inch; Messrs. Maudslay and Field proving their boilers, for instance, to 75 lbs. on the square inch before they leave the works. The attempt to displace these with generators—novel in all their features, and intended to carry as much as 100 lbs. on the inch—has resulted, as might be expected, in failures. We believe that such pressures are admirably adapted, when combined with expansion, to promote economy of fuel; but it is next to impossible to construct a thoroughly good marine boiler which will carry them, without priming, boiling dry, leaking, or generally doing that which it should not. A certain space is devoted in every steam ship to the boilers, and a certain space to the stokehole; and the boilers must be so designed, that all repairs involving the handling of long tubes, &c., can be performed from this last. Thus, the lengths of the ordinary tube flues are either regulated by, or regulate, the width of the firing space; as otherwise, they could neither be removed, nor replaced when occasion required. For this reason, a boiler could not be repaired, under ordinary conditions, in which the flues ran at right angles to the direction in which they are now placed. From this we may learn why so many high-pressure marine boilers have failed to meet with adoption. They have been designed without any regard to these considerations; and although they might have proved perfectly successful on land, where there was ample room to gain access to every part of them, they have been unsuccessful at sea, because they could not receive substantial repairs without lifting them out of the hull.

It is quite certain that, while we retain pressures of 20 lbs. or 25 lbs. to the in., we shall never reduce the consumption of fuel in any material degree; and it is equally true that, with the rectangular boiler in ordinary use we cannot carry any pressure much higher. We may consider the complicated boiler question pretty well at rest, for the present at least; and we feel no hesitation in pointing out the cylindrical fire-box boiler as the best for the marine engine, as it has been for the locomotive. The working necessities of these generators, and the rules regulating their construction and proportion, are, perhaps, better understood than anything else connected with the steam engine, while their performance and durability is everything that can be required by the most fastidious. The only question remaining for solution is their adaptability to the space which can be afforded them on board ship. Under its present form the locomotive boiler is, doubtless, inadmissible; one of the strongest objections being, that for reasons already pointed out, flues could neither be cleaned nor replaced. A tubular boiler of the kind, however, made flush with the fire-box, and 5 ft. in diameter, would easily carry 60 lbs. of steam per square inch, while the flue tubes could be replaced through the fire-box. Six or seven feet is the usual length of the tubes in an ordinary marine boiler, the grates being generally a little longer. A cylindrical boiler might be constructed with a 7 ft. grate, and tubes 6 ft. 9 in. long, from which, by using a large number of tubes of small diameter, very good economical results might be attained. Arranged fore and aft, side by side, three or four such boilers would occupy very little more space in the length and breadth of the ship than that taken up by those of the ordinary class; while the space above them could be advantageously employed as a coal bunker if the ship was a small one.

It is sufficiently strange that all the attempts hitherto made at the introduction of economical marine engines have entailed the use of enormously heavy machinery. The prejudice against high piston speed, is, or rather has been, so universal, that light quick-actioned engines have never had a fair trial. Very large pistons cannot be employed with high-pressure steam, in consequence of the injurious shock which it produces when acting on a large surface at the commencement of a stroke. Double-cylinder engines, in which the steam acts first in a small cylinder, expanding thence into a larger one, have been thus rendered indispensable. Such engines are unavoidably heavy and expensive, to say nothing

of the great space which they take up in the hull. This kind of machinery never can come into general favour with private companies, whatever it may do with the Government. Nor is it necessary that it should. A certain amount of area should be divided among a number of small pistons, not concentrated in one or two larger ones. By doubling the speed at which pistons are driven at present, that area may be reduced one-half, and the shock of steam of 60 lbs. or 70 lbs. to the inch need no longer be dreaded. Steam should give out its useful effect in the same cylinder which it first entered, as the injurious results which attend its flow through long ports and passages are thus avoided, while the valve gear is simplified, and minor matters of detail more easily worked out. Apart from these considerations, we may remark that, engine framing generally is much too heavy: mere weight never secures strength, but, on the contrary, tends to strain every rib and frame connected with the engine.

Our Government have expended, within a very few years, over two millions and a half of money on a series of costly gunnery experiments which have resulted in no practical good. We venture to say that had one half the sum been expended on the improvement of the engines intended to propel our war ships, it would have produced results of the greatest value to the nation. The most powerful ordnance ever constructed becomes valueless if placed on board vessels which can neither steam fast, nor yet keep the sea more than a few days at a time. We feel little doubt that the day is not far distant when masts and sails will be regarded in the same light in the Navy as they are in the mercantile steam marine—that is, as incompatible, when of full size, with high speed. Our Navy should rely on its engines almost wholly. Until it does, our best ships must remain comparatively slow under steam, and still slower under sails, and will, we fear, be found wanting in a warfare in which success will surely wait on speed.

SUBMARINE CABLES.

The practicability of ocean telegraphy is once again to be tested on a considerable scale. Four undertakings of this description—two being enterprises of world-wide importance—are in various stages of progress, and will, it is hoped, become established facts in the course of the approaching year. By their success or failure, the progress of this branch of science will very probably be influenced very materially. We propose, therefore, to glance at the means about to be adopted for carrying out each of them.

The French line may be first mentioned. This cable has been undertaken for the Imperial Government by Messrs. Siemens, Halske, and Co., and is shortly to be laid between Oran, in Algiers, and Carthagena, in Spain—a distance of some 250 miles; the communication being continued from the latter place by means of land wires through the Spanish territory into France. The cable is on the plan which has been patented by Messrs. Siemens and Co., and of which specimens were shown in the Exhibition of 1862—with the exception that the insulation of the present cable is entirely of gutta percha, instead of part gutta percha and part india rubber, as originally recommended by the inventors. The conductor is a strand of 3 No. 22 copper wires laid together spirally; and the diameter of the core, consisting of the insulator and the conductor, is about 3-10ths of an inch—this is surrounded by a pad consisting of a double layer of hemp strings running spirally in opposite directions. Around these hempen strings is laid the final metallic sheath, which is made of phosphuretted copper rolled into ribbon about a quarter of an inch in breadth and the 20th of an inch in thickness. The ribbon so made is laid in a short spiral, every turn overlapping the one preceding it after the fashion of ancient scale armour. The diameter of the entire cable does not exceed 4-10ths of an inch, and the specific gravity is low; but the policy of employing so small a conductor, and an insulation so slight, may fairly be doubted, as also may the weakness of the completed cable under strain.

A more extensive undertaking than this will be the cable now in course of shipment by Mr. W. T. Henley, of North Woolwich, for the Indian Government, and the laying of which has been entrusted to Messrs. Bright and Clark, under whose specification and superintendence, it has been manufactured by Mr. Henley. The core consists of a copper conductor, which, though presenting a solid appearance, consists, in fact, of several segments drawn out together and firmly encased in a surrounding tube. This arrangement is supposed to secure all the advantages to be derived from solid copper, without the danger of internal and unperceived fracture of the conductor, on account of its liability to which, that form of the latter has long been laid aside in favour of conductors worked into a strand. A conductor so constructed may escape severance in shallow water, like that of the Persian Gulf; but for deep sea cables, a conductor of that class would be a very dangerous experiment.

The conductor of the Persian Gulf line weighs 225 lbs. to the nautical mile, and is surrounded by 275 lbs. of gutta percha per mile for its insulation. The core thus formed is padded with a spiral ribbon of hemp saturated in tar-mixture, the hemp in turn being surrounded spirally by 10 No. 7 iron wires. Finally, the entire cable so constructed, is lapped with yarn over its external circumference and served with a composition of pitch, tar, and silica, laid on at a heat of 300 deg. Fahr., for the purpose of preserving the outer iron wires from oxidation. The cable is to be taken out to the Persian Gulf in five vessels, three of which have already started on their way to that rendezvous. One, however, the "Assaye," has been driven into Plymouth, where she still remains, by stress of weather. They are sailing vessels; and it is intended to tow them by means of steamers during the paying out, the depth being scarcely anywhere more than 50 fathoms. The cable will be laid in several sections, commencing at Bussora at the head of the Gulf, and completing the work at Gwaddell, on the coast of Belochistan, whence the wires are continued to Kurrachee, Bombay, and the most important centres in India. The length of this cable is over 1,200 nautical miles.

The third cable is a sort of adjunct to the last mentioned, and will be similar in construction. Its importance consists in the fact, that it forms a link of about 60 miles in the communication with the East, which it connects with the direct European lines going west and north from the coast of Italy.

But the circumstance to which the chief importance attaches in the present history of submarine telegraphs, is the resuscitation of the original Atlantic Telegraph Company. They have now provided the means for purchasing a new cable, and the attempt will be made to restore communication with America during the summer of 1864. On the present occasion, the Board have committed their scientific affairs and the judgment of the tenders sent in reply to their advertisement, to a Scientific Committee, composed of Mr. William Fairbairn, Mr. Joseph Whitworth, Captain Douglas Galton, Professor Wheatstone, and Professor William Thomson.

These gentlemen decided in favour of Glass, Elliot, and Company's offer, but required, as regards the external armour of the cable, that they themselves should institute certain experiments and finally determine how it was to be constructed.

As regards the core, it has been generally conceded that the one fixed on is suitable. It will be made up of a conductor having seven wires laid spirally into a strand containing 300 lbs. of copper to the nautical mile. The insulator will be of gutta percha, laid on in four layers, alternately with four layers of Chatterton's compound. The entire insulator weighs 400lbs., and the entire core 700lbs. per knot.

As to the external covering, the problem new being worked out at Greenwich, and at the works of Messrs. Fairbairn, is to obtain for the whole cable completed, a specific gravity, of about 1·8, with a breaking strain of about 9 tons, giving thereby a cable capable of bearing about 13 miles of its own length perpendicularly suspended in water.

As the greatest depth of the route between Newfoundland and Ireland is only 2½ miles, it is thought that this will leave an ample margin; and as it is stated that a cable of this description can be constructed by means of a combination of hemp and the best charcoal or homogeneous iron without any unattainable increase of expense, it is most probable that these materials, in proportions now being ascertained by actual experiment, will constitute the external coat of the future Atlantic cable.

So sanguine are the contractors of being able to succeed in this great work, that they have materially increased their pecuniary interest in the share capital of the Company since the contract has been awarded to them.

Glass, Elliot, and Company, have undertaken the entire work of manufacturing and laying the cable, and are to hand over the communication to the directors in perfect order during the summer or autumn of 1864; their profit of 20 per cent. being payable in twelve monthly instalments (to cease if the cable is imperfect), commencing immediately the cable is in efficient working order.

LARGE DRIVING WHEELS FOR LOCOMOTIVES.

Few things have been more over-estimated than the importance of high driving wheels for express engines. We may, perhaps, trace back the origin of the idea to Brunel, who designed and caused to be built more than one locomotive with 10 ft. driving wheels, and but 475 square feet of heating surface, or thereabouts. Need we say that these engines were total failures. What between their small power of making steam, and the size and weight of their wheels, they were almost unmanageable, and brought large drivers into disgrace for a time. The very infancy of the railway system, however, was distinguished by an intense desire on the part of most engineers for the attainment of speeds, which we, even with our superior facilities for construction, regard as excessive. The principles governing the action of steam were not understood then as well as now; and from fancied difficulties connected with its passage to and from the cylinders, a slow reciprocation of the piston was deemed worth having at any sacrifice. Larger and larger wheels were therefore adopted as soon as the reaction succeeding Brunel's failure had set in, and

some years since we arrived at the very general employment of an 8-ft. wheel for express engines. High wheels were early adopted by American builders. In 1849, several engines were placed on the New York and Erie Railroad, with two pairs of 7-ft. drivers; the cylinders, 14 in. diameter, having the enormous stroke of 32 in. Eight-feet drivers are still used on the Camden and Amboy Railway; strangely enough, with goods engines. In France, Gouin and Co. built an engine, "l'Aigle," in 1854, with drivers 9 ft. 4 in. in diameter, with outside level cylinders 16½ in. in diameter, and 31½ in. stroke. Several engines with 8-ft. wheels may be met with on many of the French lines. Neither here nor elsewhere, however, do these great diameters gain in favour, except for exceptional locomotives of great size; and the engines which prove their superior efficiency by doing most work, seldom have drivers much over 6 ft. in diameter. Our friends at the other side of the Atlantic have been so thoroughly convinced, by practical experience, that the adoption of a large wheel is not only unnecessary, but positively injudicious, that the practice of "cropping" drivers was at one time almost universal; engines with 7-ft. and 8-ft. drivers having these removed, and replaced by wheels a foot or two less, with manifest advantage.

The size of a driver has really very little connection with the speed of an engine. There is no good reason whatever that a pair of pistons should not do their work as well, when moving at 1,100 ft. per minute as at half that speed. It is merely a question of wear and tear; and railway statistics prove that piston speed exercises little if any influence on expenses incurred for repairs. Indeed, it is not easy to see how it can. Some years ago, when locomotive construction was not so well understood as it is now, very considerable difficulty was experienced in keeping pistons fast on their rods. They worked loose continually, and every now and then smashed through a cylinder cover. But this occurred with the pistons of all sorts of locomotives, both slow and fast. Improved methods of valve setting, by providing a moderate amount of compression, quickly obviated the evil, and even had it not done so, we now understand how to forge the piston and rod in one piece, so as to render such a catastrophe impossible. We have ere now pointed out, that the pressure on the piston is no measure whatever of the strain on the crank pin, especially in quick-working engines. The proper combination of the expansion of the steam with the momentum of the reciprocating parts, enables us to equalize these strains, reducing the danger of fracture to a minimum. The engine, indeed, if properly balanced, may, from this reason alone, run with less danger of accident at a high speed than at a low one, provided the principle of expansion is properly carried out.

Engines, with high drivers, are notoriously bad at a dead pull. It is urged, indeed, that under any practicable load which we can place on a single pair of drivers, a 17½ in. piston acting on a 12-inch crank, with 120lbs. steam, will cause them to slip so long as they are under 10 ft. in diameter. We much doubt the truth of the assertion however, provided the rails are clean; and the engineers of express engines know but too well, what it is to struggle up an incline with a slightly abnormal load. The actual tractive power of an engine, with 4 ft. drivers is, *cæteris paribus*, just double that of one with wheels twice the diameter, and the former, will—speeds being the same—develop just half the horse-power of the latter per mile. It is a necessity, in fact, with the engine with high drivers, that it must run at speed to develop power with heavy loads; high wheels preclude speed; hence we find that express trains seldom weigh over 50 or 60 tons. Were smaller drivers employed, the same speeds could be attained, while inclines, or an extra carriage or two, would present none of the difficulties which they do now.

It is quite possible to overcome this want of tractive force by adopting large cylinders. We question, however, that a recourse to this expedient is advisable. Engineers are well aware that the dimensions of the cylinders are generally a measure of the size of the engine. Although they do not necessarily entail an increase in the capacity of the boiler, still large cylinders require stronger framing, larger valves, and heavier connecting rods, &c., than those of smaller diameter. These matters quickly swell the proportions of an engine to something very considerable; and we may, in consequence, determine without much hesitation, that weight in an efficient express locomotive is in direct proportion to the dimensions of the driving wheels. Now, it does not require a very profound knowledge of railway matters to demonstrate that small engines are invariably more efficient, proportionally, than large ones; and permanent way complains sadly of the usage which it meets with from engines with 12 tons on a single pair of driving wheels.

Speed really depends on boiler power, and the rapid reciprocation of the pistons is no real evil. Theoretically objectionable, practice proves, in the clearest manner, that working expenses are not increased by it to any appreciable extent. Immense driving wheels no longer enjoy the popularity they once did; and we much doubt that any engines are now being built with them. Indicator diagrams taken from an express engine, with 7 ft. 2 in. drivers, at a speed of 63 miles per hour, are almost identical with those taken from a nearly similar engine, with drivers a foot higher, at 60 miles per hour. The indicator is, after all, the real test of the good qualities of a locomotive, as far as the action of steam is concerned; and we regard such a result as pretty conclusive evidence that nothing is to be gained by the use of a wheel much over 6 ft. in diameter. A rapid reciprocation of the pistons permits the use of a large blast-pipe, as the blast in the chimney is equalized, and rendered more effective, while it does not cut up the fire so much as an exhaust at comparatively distant intervals. Regard the matter as we may, we believe that there is no difficulty in proving that the most efficient engines ever built have had driving wheels of moderate diameter; and railway companies will find it good policy to return to their use.

THE IRON TRADE OF BELGIUM.

THE following account of the Iron Trade of Belgium appears in the official report by Her Majesty's Secretary of Legation, at Brussels:—

Iron ore is found in abundance in every province of Belgium, but principally in Namur, Hainaut, Liege, and Luxembourg—the four mining provinces. That found in the five Northern Provinces is all so-called "alluvial" ore found on the surface, and not in subterranean mines. The following are the three main varieties of ore raised in Belgium.

Pyrites, a combination of sulphur and iron, long treated by the Custom-house solely as iron ore, and as such prohibited from export, by an erroneous interpretation of the tariff. It is now recognized to be worthless for its ferruginous constituents, but is much demanded, and exported in large quantities to France and England, for the purpose of making sulphuric acid.

Oligist ore is a red oxide of iron, generally impregnated with phosphorus in such large proportions as to yield a pig iron too brittle for refining purposes. It used to be quite neglected until M. Behr, the director of the Ongrée Iron Works, in conjunction with M. Montefiore Levi, discovered a means of utilizing it by mixing it in the furnace with a flux composed of carboniferous schist mixed with limestone. Thus oligist becomes available in the furnace in combination with yellow ore in the proportion of 60 per 100, and even alone. This Belgian invention has tended to reduce the price, and also the general quality of the metal. The prices of oligist ore vary from 6 to 15 francs per ton.

The third description is hydrated or yellow ore, and includes a great many varieties, of which the brown hematite is the best. Hydrated ore is only used for the best iron. Some rich seams of it are found in Belgium, especially at Athus, and Ruette in Luxembourg, and at Morialmé Fraire, Acoz, Ligny, Jamiolle, Tres Gomezée, Bois des Minières, and Courin, nearly all in the province of Namur. These are ores of the first quality, and give a yield of 40 per cent. in the furnace. This description of ore is still prohibited from export, excepting to France and the Grand Duchy of Luxembourg.

Since 1830, great anarchy has crept into the administration of the iron mines. The organic law of 1810 lays down the principles by which they are still nominally governed. All deposits of iron ores in subterranean veins or strata are by that law classified under the head of mines, and are not to be worked without a concession emanating from the Crown. All superficial or alluvial beds of ore are classified as "minières," and may be worked by the owner of the land, on simply serving a declaration to that effect on the provincial authorities. This legal distinction is now generally evaded. The great bulk of the iron produce is now raised from the so-called "free iron mines," *i.e.*, mines not legally conceded. Only 20 mines are provided with concessions; all the others, nearly 2,000 in number situated in 109 different communes of the four mining provinces alone, are tolerated to exist without restriction or taxation, under the name of "minières," though most of them are subterraneous. The number of these pits in 1855 was 1,208, and the labourers employed in them were 5,271; the number of communes was 64. As the number of communes having such mines has increased since then to 109, it may be presumed that the number of pits and hands employed has risen in a similar proportion. This irregularity has led to an improvident working, and even to the total destruction by water of valuable mines. Every landlord is allowed to carry on his works in his own way, subject to the control of the inspectors only for the prevention of accidents to the workmen or to the houses on the surface. Some law on this subject is urgently called for, as the tribunals refuse to execute the ancient law, and no new concessions can be granted.

The principality of Liege and the county of Namur were two of the earliest seats of the iron manufacture, and even claim the invention of the art of manipulating iron by means of coal, as also of the high-blast furnace for producing pig iron. The first of these is said to have been that of Marche-les-Dames, erected in 1340. The earliest furnaces on record were on the low Catalan principle, which yeilds at the first fusion malleable iron. The high-blast furnace and the art of casting were brought to great perfection at Liege as early as in the 16th century. Here, as in England, fruitless efforts were long made with a view of applying coal and coke to the production of crude iron. This great economical revolution was accomplished in England in 1730, but not till 1821 in Belgium.

One of the first coke-blast furnaces was established in 1823, at Seraing by Mr. John Cockerill. The extensive iron works at that place had been founded by him in 1817, with the assistance of the King. His Majesty even became a joint proprietor of them by purchasing, in 1825, the share belonging to Mr. Cockerill's brother. This factory was long without a rival on the Continent, both for its gigantic size and perfect internal economy. Mr. Cockerill showed no less genius in his financial than his mechanical combinations, and became one of the founders of the National Bank. Unfortunately, his restless spirit impelled him to embark in a great number (no less than sixty) of other enterprises in distant countries, even in Surinam. The Belgian Revolution was the first event that checked his career. The new Government claimed to succeed to the rights of King William, until Mr. Cockerill, by a great financial effort, made himself sole master of Seraing, and brought it to its highest pitch of prosperity in 1838. The National Bank having suspended payment in that year, Mr. Cockerill was

obliged to adopt the same course. He died in 1840, leaving an untarnished reputation as a liberal employer, a daring but honourable speculator, and a father of Belgian manufacturing industry. The Seraing works are now carried on by a flourishing "anonyme" company, under the name of "Société de John Cockerill," and still enjoy a European celebrity and custom. They include within the same area a coal mine, six blast furnaces, an iron factory provided with every apparatus, a steel puddling-mill, and machine factory.

Belgium possessed in 1820 about fifty iron blast-furnaces adapted for charcoal, and not one for coke. Since then a great number of the latter have sprung up in the coal-basins of Liege and Charleroy. Numerous refining and cupola furnaces, as well as puddling, rolling, hammering, splitting and wire mills, have been erected and provided with the best appliances. The wealth created by this metal alone was estimated at 81,000,000 francs in 1860, and the exports at 24,750,000 francs. Belgium does not possess, like Wales, beds of iron and coal overlying each other in the same mine, but possesses both minerals in close proximity to each other.

The number of smelting furnaces in blast has fallen from 66 in 1857 to 51 in 1860, only one more than in 1820; but these 51 being all, with 8 exceptions, adapted for coke, produced 319,913 tons of pig iron, valued at 26,500,000 francs, probably four times the amount of the earlier period. Still these figures show a great falling off since 1857. There is still a small quantity of charcoal-iron produced in the province of Namur, valued at 128 francs per ton, or 50 per cent. above the average of coke-iron. Not a single charcoal furnace remains in blast in Luxembourg, though this province is the richest in forests and in good ores. A short summary of the fluctuations of the iron trade will be afforded by the following Tables :—

Comparative Statement of the Iron Furnaces and other Metal Works in Blast, and of the number of Hands employed therein, during the following Years :—

	Factories.			Workmen.		
	1851.	1857.	1860.	1851.	1857.	1860.
Iron smelting furnaces	46	66	51	3,067	4,423	4,078
Iron foundries	85	103	127	1,446	2,501	2,847
Iron works for manufacture of wrought iron	102	95	87	3,111	5,438	6,604
Iron works for elaboration of wrought iron	85	79	82	498	851	1,067
Steel works	...	2	4	...	250	275
Lead works	8	9	20	52	118	218
Copper works	19	15	11	122	282	206
Zinc works	19	20	23	1,947	2,750	3,019
Alum works	2	1	1	11	68	85
Glass works	39	47	45	2,644	5,652	6,194
Totals	405	437	451	12,898	22,333	24,593

Comparative Statement of the Prices, at Charleory, of the Principal Descriptions of Iron, in January of the following Years, per Ton of 1,000 Kilogrammes, equal to 0·984 of an English Ton.

Description of Iron.	1851	1855	1857	1860	1861	1862
	Fr.	Fr.	Fr.	Fr.	Fr.	Fr.
Pig iron, forge	70	110	110	90	77½	77
Do. foundry, No. 1	115	150	160	112	105	110
Do. foundry, No. 5	125	150	120	90	125	125
Do. charcoal	125	175	...	155	125	125
Bar iron, rolled, No. 1	140	210	220	165	155	160
Do. rolled, No. 2	170	230	240	185	175	180
Do. strong, No. 3	200	250	260	205	195	200
Rails and accessories	170	190	215	170	157½	157½
Split iron, soft ... per ½ ton	58	92	100	77	69	70
Do. for nails, medium ,,	66	100	110	86	75	76
Do. best strong ,,	74	108	120	94	81	82
Sheet iron, 1st quality	280	350	370	260	230	230
Do. 2nd quality	270	340	340	250	220	220
Do. fine	330	410	380	290	270	280

The enormous increase in the produce of iron has not taken place without some sacrifice of quality. Bars and rails of the present day are not what they were even ten years ago. Belgian irons compete closely with our own in quality and price. In the former respect, they are superior to our ordinary descriptions, which is attributed to the universal employment of coke in Belgian furnaces instead of coal, as is usual in England. The grey pig irons generally used in England are certainly superior to the white irons used in Belgium; but they require a larger amount of puddling than the high price of labour generally enables them to receive; so that when turned out in that imperfect state they are inferior to white irons for refining purposes. Belgian bars may on an average be classed below those of Yorkshire, especially those of Lowmoor, on a par with Staffordshire, and above Welsh irons. Belgian foundry iron has more tenacity, but less ductility, than the English article, owing to the use of coke.

Great improvements have been introduced in the manufacture of iron of late years, especially Calder's hot blast. A patent has been taken out by a Belgian engineer, M. Fromont, and generally introduced, whereby the hot blast can be intensified to a temperature of 500 deg. for making foundry iron. Some articles of wrought iron, such as wheel-tyres without joints, and fish-joint bolts, can be made in Belgium more cheaply than in England; so that a British firm which has lately taken an extensive contract in Holland has ordered these accessories in Belgium. In rails, none can undersell the Welsh, but the Belgians compete successfully with them, owing to differences of quality in foreign markets. Thus, at a recent extensive adjudication in the South of France, a Hainaut firm obtained a contract for 12,000 tons of rails at 20 francs per ton higher than a tender submitted by a Welsh house.

Belgian sheet iron, particularly the best quality, called "tôles fines de commerce," is much esteemed in and much exported to France. Split iron is little used in France, but is still produced in Belgium in large quantities for the nail-makers, who prefer it on account of its cheapness to rod iron. The nail manufacture is another Belgian staple, which has attained immense proportions: it offers the great advantage of being exercised in the workman's own house, at his own fireside, and even in his own kitchen fire; it is the winter employment of thousands, who in spring migrate to France to make bricks. Belgian nails are exported to all parts of the world.

The exports of machinery have increased from 4,750,000 francs in 1851 to 13,000,000 francs in 1861; still complaints are made of insufficient profits, owing to the constant fall of prices in the rolling-stock of railways. The French and German markets are completely closed against this branch of Belgian industry. The Russian demand is great and increasing. Italy, Spain, and Portugal take many locomotive engines annually. A fine specimen of this article, the work of the Couillet iron factory, was seen at the London Exhibition.

The history of the arms trade seems to be one of unbroken prosperity; the demand seems to be insatiable. The year 1860 already showed the largest export of small arms on record, but was surpassed in the proportion of 2 to 3 by its successor, which showed an export of 18,000,000 francs in value. All the muskets that could possibly be supplied have been hurried off to the United States, at a great pecuniary profit to Liege. This branch of industry has been also much benefited by orders for rifles executed for Her Majesty's Government; these arms are subjected to unusually severe trials, and have thus been the means of raising the standard of quality of the higher class of Liege small-arms. The wages of labour in this trade have risen to an unprecedented height; nevertheless, some skilled mechanics formerly engaged on fowling-pieces of high finish have been out of work, or have been obliged to learn to make muskets. The Liege arms manufacture is principally carried on by the men in their own houses. The numbers of firearms tested at the Liege "banc d'épreuves," exclusive of those manufactured at the Royal foundry, were, in 1859, 481,767; in 1860, 562,279.

The iron exports of all kinds have risen from 11,750,000 francs in 1851 to 25,000,000 francs in 1857 and 1860; the values for 1861 are not yet assessed, but the quantities show an increase on the whole, though a decrease in some articles, such as nails and rails. The export of pig iron has receded since 1857, owing to the increase of duty in the Zollverein; but that of ores and wrought iron has been and is constantly progressing. The year 1861 has been one of depression, but not of total stagnation; prices have fallen back to the ruinous figures of 1847, and the profits of the blast furnaces have been little or nothing. The iron factories have done rather better, and have been fully employed, though at low rates.

The Belgian ironmasters have shown themselves advocates of progress and free trade; they have declared themselves ready to meet English competition, though at present in possession of a virtual monopoly of the home trade. Some small quantities of Swedish pig iron, and of English wire, steel, and hardware are imported. Every effort is made by this powerful industry to force a sale of its produce abroad. Four of the great Hainaut firms, those of Couillet, Monceau, Chatelineau, and Thyle-Château, have combined to form an "Union Sidérurgique" for the purpose of maintaining joint agents in foreign countries to canvass for orders. The shares and profits of all these undertakings have fallen to a low ebb. The last quotations show a slight reaction in prices; the firmness of the English market is acting on that of Belgium.

ON IMPROVEMENTS IN MACHINERY AND APPARATUS FOR CLEANSING AND PURIFYING CASKS.*

By Robert Davison, C.E.

In the Paper which the author had the honour of reading before this Association in the year 1849, on the "Desiccating Process," he took occasion to mention its application, amongst others, to the purifying of brewers' casks, and further stated that upwards of one million casks had at that time undergone the process. It was not, however, made clear that the casks had to undergo a previous operation, namely, that of cleansing, which was effected by machines of peculiar construction, completely removing all adhering matter from the inside without resorting to the expensive and injurious system of unheading.

The object of the present Paper is not only to confirm all that was then stated as to the efficiency of the hot air system by stating that upwards of eleven millions of casks have since been treated in like mannner, but to illustrate still further the importance of a proper system of cleansing casks before any purifying process is applied.

It may seem at first sight but an indifferent matter to bring before an important Association like the present; but when it is considered that there are no fewer than 2,400 public breweries in the United Kingdom, who brew something like 20,000,000 barrels of beer annually, and assuming that at least an equal number of casks require to be cleansed, it becomes a matter of considerable importance how, and at what cost, this enormous amount of work is accomplished.

As regards the cleansing process, it is worthy of note that the first successful introduction of machinery for this purpose was in the year 1843, when the author, in concert with Mr. W. Lymington, produced the machine already referred to, as well as the improved mode of purifying.

Previous to this period, the only known method of cleansing was by the introduction of steam or hot water, or both, assisted by a chain placed inside, and a rolling motion given to the cask by hand. By such means it will not be difficult to see how uncertain would be the internal state of the cask.

The machine invented in 1843 consisted of a double frame, suited to the form and size of each cask, the frames revolving one within the other and at right angles to each other in such a manner as to cause a chain of peculiar construction, assisted by hot water, to traverse completely over every portion of the cask, and so effectually remove all adhering matter. These machines still continue to be held in high repute at many first-rate establishments, and so far as cleansing is concerned, they are nearly, if not quite, equal to anything which has since been attempted in this way. There is, however, one objection to them, namely, they are only calculated to cleanse one cask at a time, which, in such establishments as the two leading Burton houses (whose demand for casks each day amount to thousands), has been a complete bar to their introduction and use. The new machine now placed before the Association not only gets over the difficulty in respect to the number of casks cleansed at one time, but is superior to the old machine in point of speed generally. This machine consists mainly of two circular discs with an upright shaft or spindle in the centre, which has a screw at each end (the threads being cut right and left handed). The two discs have likewise each a corresponding female screw, which, when turned round on the upright spindle (the same being temporarily fixed), it will be easy to see, will cause the discs to advance or recede from each other, according as they are turned to the right or left hand. Such is the mode

* Read at the British Association.

by which the casks are either secured or released from the machine—that is, by turning in one direction, the casks are effectually secured between the two discs; by turning the reverse way, they are released.

Any number of casks which the bottom disc will contain, and even a second tier (if desired) can be fixed and afterwards cleansed at one operation—say two sets of 5 or 10 casks.

A compound motion is given to this machine not dissimilar (so far as the outer action is concerned) to the old machine, but, from the fact of the cask being placed in an upright position in the machine, and likewise surrounding the middle shaft or spindle, the casks themselves, when the machine is set in motion, are twirled about in a manner altogether peculiar and effective.

The best cleansing medium is found to be a small quantity of sharp shingle along with two or three gallons of hot water.

The time occupied in cleansing ordinary dirty casks is about 5 min., and very bad mouldy casks about 12 min. Thus it will be seen, that one of these machines is calculated to cleanse easily 100 ordinary casks, or 60 mouldy ones per hour, at the mere expense of two or three labourers and an insignificant amount of engine power. In large establishments where unheading is still resorted to, the saving to be effected by this new machine must of necessity be great.

With regard to purifying both new and old casks, there can be no doubt that the wisest course for new casks is to divest the wood as much as possible of the coloured juices before it is made up into casks, which is easily done by hot water or steam, and it is afterwards dried by currents of hot air.

Old and tainted casks are found to be cured (within 1 in 200) by partial steaming, and afterwards by exposure to currents of hot air at 450 degs. Fahr.

Experience having sufficiently proved the soundness of this mode of preparing casks for a most important branch of trade, it may seem almost needless to suggest any other method of performing the same work; but the author being the first to discover the importance of applying heated currents to such a purpose, he feels it incumbent on him to state that there is still another element which he is not sure must ere long supersede to a considerable extent the one before referred to. It is that of super-heated steam, the use of which was discovered lately by the author in rather a singular manner—namely, while engaged on some experiments with superheated steam, it occurred to him, seeing that there was an indicated temperature at the time of between 600 and 700 deg. Fahr., that it would be well to try its effect upon a very bad stinking cask, which, being obtained, was subjected to the heat only ten minutes, when it was pronounced perfectly sweet. It is only necessary to add that the same result has attended many repetitions of the system, and although they have not all been attended with the same successful results, the author feels that it has not arisen from any fault in the principle, but from a want of sufficient practical data as to the exact temperature and also the amount of time to which the casks can be safely exposed to this powerful agent.

SOCIETY OF ENGINEERS.

At the last meeting of this society, on Oct. 5, 1863, Mr. William Roberts read a Paper on "Steam Fire Engines, and the late Trials at the Crystal Palace."

In introducing the subject of steam fire engines to the notice of the Society of Engineers, Mr. Roberts said that it was quite unnecessary to enlarge upon the saving that must occur from the use of them as compared with hand-worked or, as they are commonly termed, manual engines. It is sufficient to say, that, from carefully conducted experiments with two engines, having pumps identical in every respect, but one fitted to a manual and the other to a steam engine, he found that from six to seven times as much work is done, with a consumption of 2 cwt. of coal, or say *two shillings and sixpence*, as was done by the manual for *thirty shillings*.

The honour of constructing the first steam fire engine is undoubtedly due to Mr. John Braithwaite, who, in 1829, constructed one that did good service at several large fires in the metropolis, particularly at the Argyle Rooms and Messrs. Barclay, Perkins, and Co's. brewhouse. A full description of this engine will be found in the 12th volume of the Mechanics' Magazine, February 13th, 1830.

In 1832, Mr. Braithwaite constructed another steam fire engine for the King of Prussia; and Mr. Roberts stated that he was informed that it is still at work, although, like the high-mettled racer, it has descended in the social scale, being now used to pump the water from a mine.

Nothing more was done in England for 30 years with regard to steam fire engines; but in the year 1840, the Mechanics' Institute of New York offered a gold medal for the best plan of steam fire engine, and this was obtained by Captain Ericsson, a gentleman who had been for some years with Mr. Braithwaite, and who evidently remembered what he had seen here.

This engine was very similar to Mr. Braithwaite's first engines.

About the same time, a Mr. Paul Hodge constructed a steam fire engine for an association in New York, the principal feature of which was that the steam power was used as an auxiliary to propel the engine.

From this time the steam fire engine made steady progress in America, fire companies were formed, and these being taken under the protection of the State, having certain privileges granted them, became emulous of each other, and anxious to have the best engines that could be got. Some of the most eminent engineers found it worth their while to take the matter in hand, and, as a natural consequence, our cousins across the water had some very good engines whose "puff, puff," could be heard at their fires; whilst we, with our old-fashioned notions, could only hear the "bump, bump," of our hand engines, relieved now and again by the cry of "*beer, oh!*"

Until the year 1852, nothing was done in this country; but in this year the authorities appear to have discovered that working the floats by hand was rather expensive, and one of them was put into the hands of Messrs. Shand and Mason, of the Blackfriars-road, who removed the hand gear and substituted steam power. Steam cylinders were placed over each of the water cylinders, a crank shaft working in slotted cross-heads between them; and all things considered, these engines worked as well as could be expected, except the propelling, which was a miserable failure.

The saving in working this float was, however, so satisfactory, that the authorities decided to have a boat built expressly as a steam fire engine. This was done in 1855, the boat being built by Mare and Co., of Blackwall, and engined by Messrs. Shand and Mason. The steam cylinders, two in number, are 14 in. in diameter by 18 in. stroke, the water cylinders being 10 in. in diameter, also 18 in. stroke. The engines are horizontal—one on each side the boat, and a large Appold pump is placed in midships to propel the boat upon the reaction principle. This engine is about 80-horse power nominal, but is frequently worked to nearly double. It is capable of throwing four 1½ in. jets at the same time; and at the great fire in Tooley-street it worked nearly 400 hours. This engine has lately been altered. The propelling jets are brought above the water upon Ruthven's principle, and although a decided improvement, the float is still very slow for the power applied.

About this time the East and West India Dock Company had a large Downton pump fitted on board their tug-boat "Dragon," to be worked by the boat's engines. This is a very good fire engine, throwing a 1½ in. jet from 180 ft. to 200 ft.

In May, 1856, in a discussion that took place at the Society of Arts, upon a Paper read by the late Superintendent of the London Fire Brigade, Mr. Braithwaite roundly charged the insurance companies with not being anxious to get fires extinguished; and the answer given by Mr. Braidwood went far, in Mr. Roberts' opinion, to explain how it was that steam fire engines had made so little progress in the country. Mr. Braidwood said—"He could also state that the subject of steam fire engines had been seriously considered; but if the fire offices were disposed to incur the cost which six or eight of these engines would involve, there was not at the present time an adequate supply of water from the mains to work any number of them at a fire; there was scarcely a sufficient supply for ten or twelve of the ordinary engines now in use. Therefore, steam fire engines—admitting their great efficiency—were out of the question, until a larger supply of water could be obtained. If he might compare small matters with great, he would liken the steam engines to a battering train—most efficient when well placed and served, but slow of movement and requiring large supplies. The common fire engine, well constructed and not too heavy, might be likened to field artillery, which from its power, but especially from the rapidity of its movements, was invaluable, to carry out the simile. Hand-pumps might be supposed to take the place of musketry, which might be used when and where it was desired—from a hand-basin if necessary. With regard to the supply of water, his impression was, that when they had an adequate supply for steam fire engines, a higher pressure would be given, so that they could work from the mains without requiring the steam fire engine."

Mr. Braidwood lived long enough to see his mistake, and to pen the following in his last report:—"That at large fires beyond the reach of the steam floating engines, the land steam fire engine had been of great service; it is not only the large quantity it throws, but the great height to which it is thrown that makes it so valuable; at the same time, it can be worked as gently as a common (ordinary) engine."

In 1860 Messrs. Shand and Mason constructed an engine (the one just referred to). This worked for something under twelve months; its last appearance being, I believe, at Tooley-street. Its fate was pretty nearly predicted at one of the meetings of the society of Foremen Engineers by Mr. Stabler, reported in the Mechanics' Magazine, March 1, 1861.

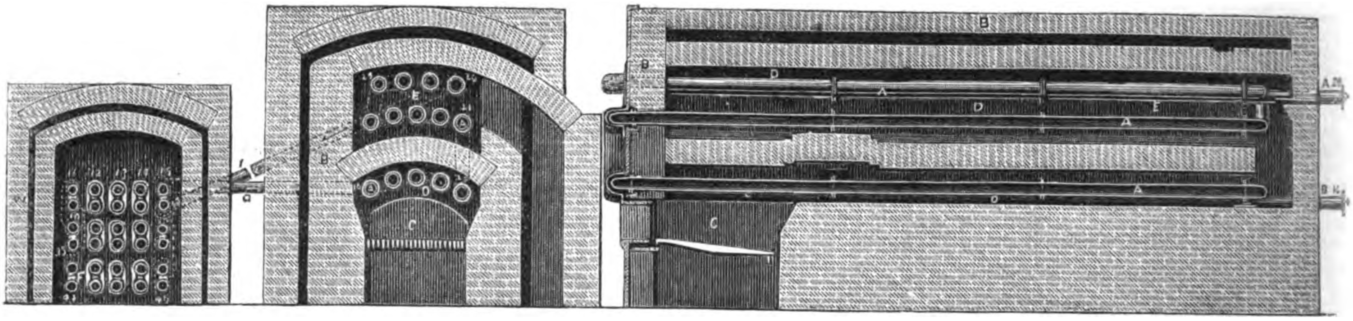
(To be continued in our next.)

A NOVEL APPLICATION OF WATER POWER.

Just forty years since, M. Fourneyron commenced a series of experiments in water power, which resulted in his invention of the turbine or horizontal water-wheel. Since that period considerable improvements have been made in the turbine by different persons, the chief and most useful having been effected by Mr. Schiele, of Manchester, whose ingenious applications of mechanical curves seem to have been fully adapted by him for the production of this form of motive power. One form of his arrangement for supplying power we have recently seen (working the bellows of a powerful organ) at the residence of a citizen of Manchester, where the impression was given that, if all the results achieved by Mr. Schiele be equally successful, a new feature will be rapidly developed in applying water power, especially in cases where a small amount of power may be required at irregular periods; as in the case of working the bellows of organs, driving small lathes, fans for ventilation, printing and other presses, sewing machines, washing machines, &c. In the house referred to, a water-wheel, 4 ft. in diameter, consuming 15 gallons of high-pressure water per minute, formerly employed to work the bellows of an organ in the drawing-room over the cellar wherein the water power was produced, has been replaced by a turbine only 1¼ in. in diameter, with a 3-in. case 1¼ in. wide, supplied by a ⅜-in. pipe, and consuming less than a gallon of water per minute. An ingenious and yet very simple economical regulator, invented by Mr. Eccleston, organ builder, of this city, works in connection with the apparatus just mentioned, by means of which the organist may easily supply his instrument with the required wind by simply turning a handle near the organ. By availing themselves of the ample supply of high-pressure water secured to the city by our Corporation, all persons using machines requiring a small amount of power appear now to have supplied to them by this invention the means of working their machines with no trouble and at a trifling cost; while at the same time this kind of turbine appears to be equally well adapted for turning large mills and works, even when they require several hundreds of horses' power. Orders are now being executed by Messrs. Schiele and Co. for the construction of 50 small turbines, to be used as direct-action fans (the turbine and fan being on one spindle) for the production of the new gas obtained from petroleum. Several powerful turbines will shortly be at work in this locality, when our readers will be able to see and judge for themselves of the extraordinary yet simple effect of this new water engine, which seems to be equally suited for the requirements of the sewing machine in a lady's boudoir, the washing machine and mangle in the laundry, or the hydraulic press and hoist in our huge warehouses. In fact, wherever our Corporation waterworks will enable persons to turn a water tap, and thus to supply at a moment's notice the power required, these machines will be available; while all the risk from fire and the cost and trouble of steam boilers and engines will be avoided.—*Manchester Guardian.*

CLARK'S APPARATUS FOR SEPARATING VEGETABLE FIBRES.

Fig. 1. Fig. 2.



CLARK'S IMPROVEMENTS IN SEPARATING VEGETABLE FIBRES.

This invention, patented by William Clark, engineer, Chancery-lane, relates to the separation of the fibres of vegetable substances and the extraction of their gummy and colouring matters, by subjecting them to the action of water brought to a temperature at which it boils under a pressure greater than that of the atmosphere, either with or without the use of alkalies, or of rubbing, grinding, or beating devices as an aid to maceration. In such method of separation, as heretofore practised the boiler or macerating apparatus has been charged while at a temperature below 212 deg. Fahrenheit, and after closing it the charge has been heated to a temperature of from 300 deg. to 350 deg. Fahrenheit, at which it has been kept for a sufficient time to effect complete maceration, and then the apparatus has been completely discharged and recharged for a new operation. The process conducted in this way involves the loss of all the time occupied in discharging and recharging and in heating up again from below 212 deg. Fahrenheit to the much higher temperature required, and the waste of all the heat contained in the matter at the time of its discharge, which takes place at the high temperature above mentioned.

The object of this invention is to obviate this loss of time and waste of heat, and consists in effecting the macerating process without interruption by supplying and discharging the material and the water necessary to effect maceration in a continuous manner by means of a forced circulation through the boiler or macerating apparatus effected by a pump or other equivalent forcing apparatus.

It also consists in saving the heat of the discharging pulp or macerated material by retaining it under pressure after it has left the boiler or macerating apparatus, and passing the incoming fibrous material and water in a contrary direction to the discharge through a suitable system of pipes or passages properly arranged in contact with or in relation to the discharge pipes or passages.

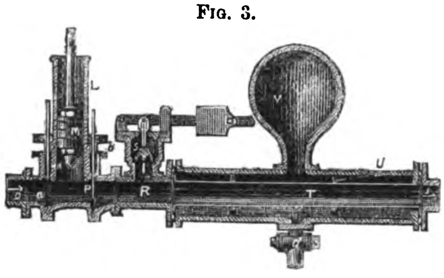
It also consists in forcing the fibrous material through a mill or other grinding, rubbing, or beating apparatus employed in connection with the boiler as an aid to maceration by the combined or simultaneous action of the pump or forcing apparatus by which the forced circulation through the boiler is produced, and of the pressure due to the heat of the steam or water in the boiler.

It also consists in the construction of the forcing pump by which the forced circulation through the boiler or macerating apparatus is produced with sharp-edged valves so applied and operated as to cut any straw or other material which may be left in the valve passages when the valves close, and thus ensure the perfect closing of the valves and prevent leakage.

It further consists in the employment for the purpose of transferring the heat from the discharging pulp or macerated material to the incoming material and water of double or twin pipes, or, in other words, pipes containing two passages through which the macerated material and the incoming material and water can flow side by side in opposite directions.

In the accompanying drawing of an apparatus which illustrates the several features of this invention, fig. 1 is a transverse vertical section; fig. 2 is a longitudinal vertical section of the boiler in the plane indicated by the line y, y, in fig. 1; fig. 3 is a central vertical section of the

Fig. 3.



forcing pump and its appendages for feeding and producing a continuous circulation through the macerating apparatus. Similar letters and numbers of reference indicate corresponding parts in the several figures. The boiler represented is composed of a train of pipes A, A, A, arranged in three tiers, one above another, in a suitable furnace B, B, the lower tier being arranged partly over the fire-place C and partly in a flue D running directly back from the fire-place, and the two upper tiers being arranged within a return flue E above, and the connections between the said pipes are such that there may be a circulation through the whole series—first, through one after another of the lower tier; next, through one after another of the second tier; and finally, through one after another of the highest tier. The first pipe of the lower tier is connected by a pipe G with one end of the train of twin or double pipes F, F, in which the incoming fibrous material and water are heated by the outgoing pulp or macerated material before entering the boiler; and the last pipe of the highest tier, which is the one at the extreme right of the tier, is connected with the mill, by which the fibrous substances after having been boiled for a sufficient length of time are ground, and from which they pass through a pipe to the same end of the train of twin pipes F, F, with which the pipe G is connected, but G connects with the upper and I with the lower compartment of the pipe F, which forms this end of the train. The other end of the train of twin or double pipes F, F, has connected with it the feed pipe J, and the discharge pipe K, the feed pipe being connected with the upper and the discharge pipe with the lower compartment of the pipe F, which forms that end of the train. The train of pipes F, F, is enclosed within a casing W of brickwork or other non-conducting material to prevent loss of heat by radiation. The construction of these pipes is shown in fig. 1, where it may be seen that each has two compartments or passages. The two compartments have no communication at all with each other; but the several lower compartments or passages are connected throughout the whole train, and so are the upper compartments or passages, the upper ones being for the passage of the incoming fibrous substances and water, and the lower ones for discharging the pulp. L, fig. 3, is the barrel of the force-pump for feeding the straw or other fibrous material and the necessary quantity of water for producing its circulation through the trains of pipes F, F, and A, A; M is the piston of the said pump; N and P are the induction an deduction valves, made of steel plate, fitted to slide in suitable guides against steel-faced seats, and having their lower edges bevelled to sharp edges to enable them to cut with a shear-like action against the lower edges of the openings in the valve seats, and thus sever any pieces of straw or other fibrous material that may be in their way as they move downward to close. The valves pass through suitable stuffing boxes, and are connected with eccentrics or other suitable devices which derive motion from the steam engine or other motor by which the piston of the pump is worked. The induction pipe Q of the pump is connected with a mixing chest in which the straw or other fibrous material, cut into pieces of about one or two inches in length is mixed as thoroughly as possible with water by means of suitable agitators. The eduction pipe R has applied to it a safety valve S to prevent any injurious strain in case of any part of the apparatus becoming choked or clogged, and beyond this safety valve it is connected with one end of a pipe T, which is either composed of several thicknesses of wire gauze or finely and closely perforated all over, the said pipe being encased with a strong cylinder U, on the top of which there is an air-vessel V, and at the bottom of which there is an escape cock d; the other end of the pipe T is connected with the feed pipe J. The pipe T serves as a strainer to permit the escape of any excess of water that may pass through the pump beyond what is necessary to carry the fibrous material through the macerating apparatus and effect its maceration; and this excess of water passing into the cylinder U is allowed to run off through the cock d, which is opened whenever it is found by the state of the pulp that an unnecessary quantity of water is passing through the macerating apparatus. The air-vessel V operates in the same manner as the air-vessel of an ordinary force-pump. The mill to which the fibrous material is delivered from the boiler may be of any kind that may be found suitable for reducing the material to a pulpy state without destroying its fibres, and therefore needs no particular description.

LARGE LOCOMOTIVES.

We see it stated that the Philadelphia and Reading Railway has lately built a locomotive engine weighing 56 tons. Of its cylinder dimensions, heating surface, size of wheels, and arrangements, we have no account. We understand that it is designed to be used as a "pusher" for the heavy coal trains up a heavy grade. There are a great many of these monster lomotives scattered around the world. The heavy passenger engines of the Great Western (England) line were for a long time the most colossal in the world. The narrow gauge Crampton engine, "Liverpool," built by Messrs. Bury, Curtis, and Kennedy, for the London and North-Western line, was, in some respects, however, larger. With 18 in. cylinders, 20 in. stroke, and 8ft. driving wheels, it had 2,100 square feet of heating

surface, the boiler being oval in section and containing 300 tubes, 2 3-16ths in. in diameter, and 12 ft. 3 in. long. The weight was 40 tons. The engines originally constructed at Munich to work the Soemmering incline, were of great size, their cylinders being 20 in. diameter, stroke 30 in., whilst the eight coupled wheels of the engine, and the six wheels of the tender, which were also connected by endless chains to the driving wheels, were 3 ft. 6 in. in diameter. The whole weight thus secured for adhesion was about 55 tons. The boiler was 4 ft. 6in in diameter, the tubes were 14 ft. long, and the grate was 5 ft. long, and 4 ft. 8 in. wide. The Engerth engines, of which a large number are employed on the Northern and Eastern Railway of France, have 19½ in. cylinders, 25 in. stroke, and eight coupled wheels 4 ft. 2 in diameter. The boilers are 5 ft. in diameter, and contain 235 tubes, 2 ft. 2 in. in diameter and 16 ft. 5¼ in. long. These engines weigh about 42 tons each. Borsig's tank engines, on the Scarbruck and Manheim line, weigh 44 tons, and have 18 in. cylinders, 27 in. stroke, and six 4 ft. driving wheels. Mr. Brunel's great tank engines, on the Vale of Neath Railway, weigh 47 tons, and have 18 in. cylinders, 24 in. stroke, and six coupled wheels 4ft. 9 in. in diameter. The boilers are 5 ft. 2 in. in diameter, the tubes being 10 ft. 9 in. long. The grates are 4 ft. 10¼ in. long, and 5 ft. 8 in. wide. Some of the engines employed upon the Delaware, Lackawanna and Western Railway have 18 in. cylinders, 24 in. stroke, six coupled 4 ft. wheels, and have 51 in. boilers, containing 91 tubes 3 in. in diameter and 15 ft. 6 in. long. The grates are of the enormous size of 45 square feet, viz., 6 ft. long and 7½ ft. wide across the fire-box. Weight, 35 tons. An engine constructed by Ross Winans, has 22 in. cylinders, 22 in. stroke, eight coupled wheels 3 ft. 7 in. diameter, besides a truck, making 12 wheels in all. The Engine "L'Aigle," constructed by E. Gouin and Co., of Paris, in 1854, for the Western Railway of France, has 16¼ in. cylinders, 31¼ in. stroke, and four coupled driving wheels 9 ft. 4 ft. in. in diameter.

Exceptional cases may demand these monster engines, but the ambition to build them we believe to be far in advance of the real want. Such immense weights driven over our roads tax with great severity every portion of the superstructure, and use up with greater rapidity the common sized rails which have neither the vertical nor the lateral stiffness to resist the disarranging forces residing in these gigantic experiments. Our European neighbours have indulged in these expensive and destructive steam monsters far more liberally than we in the United States, especially in passenger Express engines. The comparatively slow speed of our heavier freight engines, prevents much of the evil to superstructure which must follow the use of heavy passenger engines.—*American Railway Review.*

POSTAL AND TELEGRAPHIC COMMUNICATION IN FRANCE.

THE *Annales Télégraphiques* states that the number of letters passing through the French Post-office, in 1862 was 300,000,000, of which 1,820,000 were registered, and 976,047 were letters containing property of a declared value of 600,000,000 francs. The number of newspapers, pamphlets, patterns, and small parcels, &c., was 190,000,000.

The gross receipts of the Post-office authorities were, in 1861, 66,781,363 francs; expenses, 42,748,373 francs, leaving a balance of 24,032,990 francs.

The accounts for 1862 are not completed, but the receipts amount to 69,906,000 francs.

The number of private telegraphic messages transmitted in 1862, by the telegraphs under Government management, was 1,521,000; the receipts were 5,315,000 francs.

To these must be added the private messages transmitted by railway companies, which amounted in the year to 80,000, producing a sum of 135,000 francs, so that the total number of private messages transmitted reaches 1,601,000, producing no less than 5,451,000 francs. The number of Government messages exceeded 500,000, representing an amount of more than 2,000,000 francs.

It appears, then, that the more the tariff of postal and telegraphic communications has been lowered, the larger has been the total sum realized. The telegraph, so far from diminishing the number of letters, seems to have tended to increase it. The hours when the telegraph is principally in operation are from twelve to three, while the exchange is open, and when business is at its height.

IRON WALLS AND THEIR ARMAMENT.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In dealing with the question of Naval Guns, it is not without design I retain the title of "Iron Walls and their Armament," under which I some time since drew public attention to the vast importance of the subject.

Armour-plate defences to ships and batteries have created a revolution in naval and siege artillery. Guns of small calibre, cast-iron shot and shell, and moderate charges were more than a match for wood and masonry. Those means of attack are futile against iron plates. The whole philosophy of the question lies in the change of the material of the defensive structures—in the resistance of iron compared to timber and bricks or stone. The erection of iron-cased land batteries at the entrances of rivers and harbours is only a question of time. The effect of the Federal fire on Fort Sumter is no more to be taken as a criterion of the value of the American guns, than the destruction of the Turkish fleet at Sinope with Paixhan shells is to be regarded as evidence of the power of modern artillery. The long range at which the Charleston forts have been shelled is simply ascribable to the application of the rifle principle, and by no means to any peculiarity of construction of the guns.

Some public writers, including those who do the war articles in the *Times*, seem to be bewildered by bombardments from distances of four or five miles, apparently unmindful of the fact that those effects are the result of rifling and high elevation combined. The extraordinary increase of range obtained with rifled guns with increase of elevation, is shown in the table of experiments with Armstrong's and Whitworth's 12-pounders, printed in my last letter. With the same charge, 1½ lb. of powder to a 12 lb. shot, or ⅛ the weight of the projectile, the latter gun, at 2 deg., gave a range of 1,198 yds.; at 5 deg., 2,867 yds.; and at 10 deg., 4,226 yds.; thus varying from about ¾ of a mile to 1½ and nearly 2½ miles. By still greater elevation the range might be extended to 4 or 5 miles; but these long ranges result in vertical fire.

In referring to the destructive effects of the Parrot and Dahlgren guns, vertical and horizontal fire are confounded. The real test of the power of a gun is horizontal fire, at point blank, with a heavy charge, a low elevation, and a flat trajectory. Bombardment at long range is a special branch of artillery practice. With the use of rifling it has attained new importance, being effective from distances which were never dreamt of with mortars and smooth-bore guns. But bombardment is rather a means of annoying an enemy and destroying his magazines, or dismounting and disabling his guns, than a direct attack on his defences. The *feu d'enfer* did not determine the fall of Sebastopol. The storm of Dahlgrens and Parrots did not advance the capture of Vicksburg, the surrender of Sumter, or the evacuation of Wagner. The sap, the mine, the breeching battery at short range preparatory to the assault, do the decisive work.

The most erroneous notions prevail with reference to American siege and naval guns. The 11, 13, and 15-in. guns, 200 and 300-pounder shot, are glibly spoken of, as if calibre and weight were the prime conditions for destructive effect; but that idea is a mistake. These large guns are fired with low charges, and give low velocities. Now every practical artillerist and trained gunner knows that, for smashing and penetrative effect, you must have heavy charges producing high velocities. The weight of 200 and 300-pounder projectiles sounds big. The *Times* was fond of imposing on the imagination of its readers by calling the 100 and 150-pounder Armstrong guns 200 and 300-pounders, simply because elongated bolts of the last-named weights were fired from the guns. As well might a double-shotted 68-pounder be called a 136-pounder.

The fact is, if the weight of the shot is increased, that of the charge must be reduced, and by that process propelling force is not gained. The momentum of a projectile, which is the measure of its propelling force, is in the ratio of the square of the velocity multiplied by the weight. That is the law in theory, according to which the products of calculations giving equal quantities, ought to indicate equal effects, but in practice that is not the case; it is found that, for destructive effect, velocity, the "vis viva," is a more important element than weight, the "vis inertiæ." This has been again and again demonstrated in firing at armour-plated targets at Shoeburyness. By the results thus obtained, the theory that penetrating and smashing effects are obtained in a superior degree with heavy projectiles and low charges, is demolished; and this theory, being the basis of the Armstrong system of gunnery, the system itself falls to the ground. The 68, 110, and 200-pounder projectiles, fired with charges of 16, 14, and 10lbs. of powder, give velocities, of which the products of the squares multiplied by the weights respectively are nearly equal quantities; but the effects on the targets do not support the calculations. On the contrary, the reports of the Iron Plate Committee prove, what is well known to every one who has witnessed the experiments referred to, that the indentations on the plates, which are the measure of the force of impact, are—for the 68-pounder, 2¼ to 2½ in.; for the 110-pounder, 1½ to 1¾ in., and for the 200-pounder a slight mark ¼ to ½ in. in depth. The illusion of the tremendous force of the 200-pounder shot was, after a few experiments, dissipated. The heavy masses of iron were found at the foot of the target innocuous, except to break off their own conical heads. There was no resisting this evidence; the great Elswick artillerist himself was convinced of the fallacy of his theory. Since that time, he has been content to have his 100-pounder called a 100-pounder, and nothing more.

So it is with the American great guns. They are vaunted far beyond their merit. They are not, and cannot with safety be, fired with charges exceeding one-tenth the weight of the projectile. Hence the velocities are low, and the smashing and penetrating effects with horizontal fire comparatively ineffective.

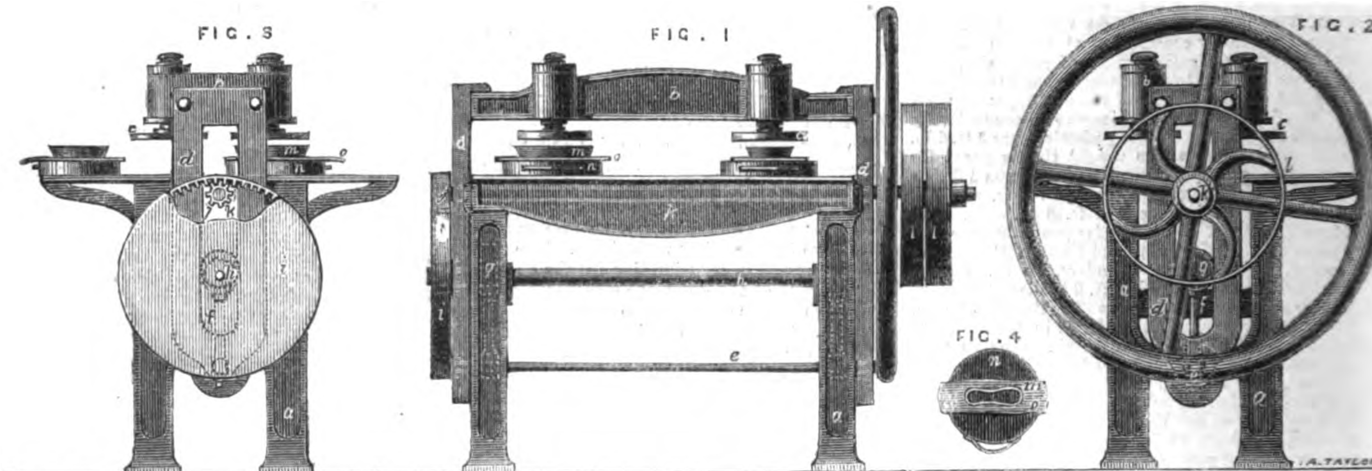
The inherent defect of rifled guns of every service, in this or foreign countries, is the *forcing* principle, by which rotary motion is imparted to the projectile. The compression or expansion of soft metal on the shot into grooves and ribs in the gun, the friction of the iron surfaces of the shot in grinding its way through the twist of the bore, whether on the hexagonal, oval, or ribbed plan, are all more or less forcing systems. The proof that they are so, is the immense loss of propelling force resulting from them, and the necessity of lubrication to protect the gun from bursting by excessive tension. This point is set at rest by comparing the velocities of shot from smooth-bore and rifled guns. Whilst the 68-pounder round shot, with a windage area of 5 per cent., has a velocity of 1,580 ft. in a second, the Armstrong, Whitworth, and other English rifled guns give little more than 1,200 ft., and the American heavy ordnance probably not more than 900 ft. to 1,000 ft.

The gun wanted for the Navy, and for coast or siege batteries, is one which shall be rifled on a plan which is not a forcing system; which shall impart rotary motion to the shot with no more strain on the gun than that resulting from the weight of the projectile; a gun which, under those conditions, may be fired with heavy charges without bursting, producing high velocities and smashing effect at long ranges. No such gun exists at present; it can only be produced by abandoning the vicious principle of obtaining rotation by forcing the shot to mould itself into or to grind its way through the rifling. The *morgue* at Woolwich of suicidal rifled guns furnishes ample evidence of the cause of self-destruction. They invariably burst at the part of the chase where the shot, suddenly put in motion by the explosion, has to force its entrance into the grooves or ribs which constitute the rifling.

I may be thought presumptuous in advancing these opinions. My object, as it was in the armour-plate question, is to promote discussion and elicit truth.

CIVILIAN.

GIMSON'S PRESSES FOR PUNCHING OR CUTTING LEATHER.



GIMSON'S PRESSES FOR PUNCHING OR CUTTING LEATHER.

This invention, patented by Mr. J. Gimson, of Leicester, M.E., relates to that description of presses in which knives or cutting tools with sharp edges bent in any desired form are used to cut out pieces of particular shapes. These cutting tools are usually made about two inches deep, and two, three, four, or more tools are frequently adapted to the same press simultaneously, in order to economize time and labour; but as the knives or cutting instruments and also the under blocks do not always wear away equally, considerable difficulty is experienced in using in the press at the same time several knives and blocks of different depths or thickness.

The object of this invention is to obviate the inconvenience arising from using knives and under blocks of different depth or thickness; and to this end the patentee employs, in combination with the moveable part of the press, as many adjustable pressing surfaces as there are knives or cutting instruments, so that each pressing surface may be adjusted separately to suit the knife with which it is intended to be employed. It is preferred that this adjustment should be made by means of adjusting or set screws, so that the pressing surfaces may be screwed up or down according to circumstances. It will be evident that, as a modification, the under block on which the substance to be cut is placed may be made adjustable vertically instead of adjusting the moveable upper plate or pressing surface.

In the accompanying drawing is shown a machine or press for cutting or punching out soles constructed according to this patent. Fig. 1 is a front elevation of the press, showing two cutting knives and blocks; fig. 2 is an elevation of one end of the machine; fig. 3 is a similar view of the opposite end of the machine; and fig. 4 is a plan view of the wooden under block, knife, and piece of leather to be operated upon.

a, a, is the main framing of the machine; *b, b*, is a moveable cross-head provided with adjustable pressing surfaces or plates *c, c*, which are moveable vertically by means of their respective screws, as shown in the drawing. The cross-head is supported by the side arms *d, d*, which are connected together at their lower ends by the cross-shaft or rod *e*. Links *f, f*, shown by dots in figs. 1 and 3, connect the shaft or rod *e* with the eccentrics *g, g*, on another cross-shaft *h*, on one end of which is keyed a box wheel *i* provided with internal teeth, into which gears a pinion *j* on one end of the driving shaft *k*, which may be driven either by hand labour or by means of a band passed round the pulleys *l, l*. The knives or cutting instruments are shown at *m, m*, and the under blocks at *n, n*, the strips of leather *o, o*, being between the knives and the blocks. Upon motion being communicated to the driving shaft *k*, the eccentrics *g, g*, will draw down the cross-head and adjustable pressing surfaces *c, c*, and by causing them to press on the top of the knives, the latter will cut through the leather on the block *n*. It will be evident that as the pressing surfaces *c, c*, are adjustable vertically by means of their respective screws, their position may be regulated and adjusted with great nicety to suit the varying thicknesses of under blocks and the depth of the knives or cutting instruments. It will be evident, as a modification of the above, that the cross-head *b* may remain stationary and the under blocks be made to rise and carry up the knives and under blocks to and against the pressing surfaces, or the under blocks *n, n*, may be made adjustable vertically instead of the pressing surfaces *c, c*.

CLEANING SHIPS' BOTTOMS.

An improved apparatus for effecting this purpose, depending on the following principles, has been recently granted protection. It is the invention of Mr. M. Hutchinson, of Devonport.

As the weight of a cubic foot of sea water is more than 64 lbs., and that of a cubic foot of cork about 15 lbs., the difference between the two—viz., 49 lbs., must represent the buoyancy, in other words, the upward pressure, of a cubic foot of cork when immersed in the sea. Mr. Hutchinson proposes that two flexible, we may call them, "mattresses," about 10 ft. long, 5 ft. wide, and 1 ft. deep, made of canvas (rendered waterproof probably by having been steeped in a preparation principally composed of linseed oil), be lightly stuffed with cork parings, or cotton, or other light suitable substance. Were it preserved air-tight, no stuffing would be necessary. It might be blown out when required for use, like an air-cushion, until sufficient air was pumped in to resist the pressure of the sea. A slight netting, or many loops, must be attached to the upper surface of the mattress.

This surface being an area of 50 square feet (representing a pressure, when immersed in water, of upwards of 2,450 lbs.), that 50 brushes (each 1 ft. in area, hexagonally shaped), with backs of light wood, or a fabric of gutta percha, be fastened to the net, or loops, by light waterproof lashings. Thus, the whole mattress will form one large buoyant flexible brush, or scrubber, in which each separate brush will receive its own distinct pressure, and thus all parts of the ship's bottom will be felt and acted on, however undulating may be the surface.

That a frame of pine wood (two sides and a bottom), strengthened at the line of junction by metal, but not so heavily as to destroy buoyancy, be made to embrace the keel, and travel along the bottom of the ship.

That this traveller, with the scrubbers attached to it (one for each side), be lowered from the bow of the vessel, and with removeable weights be sunk into position.

That by buoyant Manilla ropes running from the scrubber and traveller, through pulleys fixed at the bowsprit and spanker-boom, the scrubber and traveller be simultaneously drawn fore and aft until the part of the bottom rubbed by the scrubber (a strip 5 ft. wide) be sufficiently cleaned. That as soon as one length of 5 ft. width is cleaned, the traveller and scrubbers be hoisted up, and the scrubbers, when freed from weeds, be removed 5 ft. further from the traveller.

As the scrubbers are further and further removed from the traveller, the sides of the ship in contact with the scrubber become more and more vertical, and in the same ratio the pressure from buoyancy decreases; but, on the other hand, the useful strain upon the ropes from the traveller becomes greater, and it will be only necessary to give a stronger pull on the tackling fixed to the upper edge of the scrubber, and passed over the side of the vessel—or, more probably (to allow some play), throw over a rope extended from the rigging of one mast to the rigging of the next. The ship would have a "list" to the side that is being cleaned.

The keel would be cleaned by brushes fixed inside the traveller.

When the bottom is much fouled, it may be necessary to use brushes made with fine copper wire in lieu of whalebone; and in extreme cases metal scrapers, somewhat in the form of the letter T, would be substituted for wire on the brushes.

Scrubbers only 10 ft. by 5 ft. by 1 ft. have been spoken of; but for large ships it is presumed they might be of much greater dimensions, and be 2 ft. thick instead of 1 ft. This would more than double their buoyancy, for the additional foot would add a mere trifle to the weight. If merely filled with air they could, when emptied, be stowed away so easily, that their bulk would not be objectionable; and the traveller would occupy but little space, for its sides are supposed to be made removeable from its bottom.

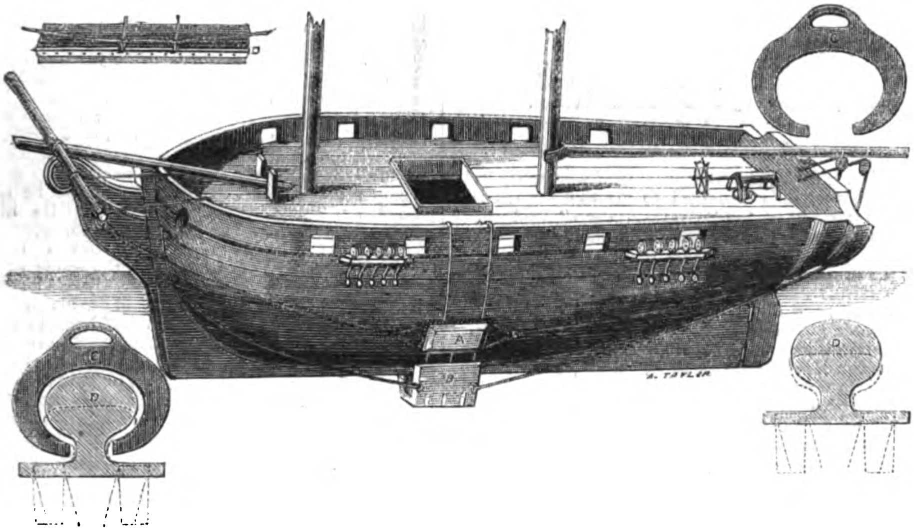
The scrubbers are kept extended by the four edges of their upper surface having a pine rod passed through one continued loop. That the scrubbers may lose none of their flexibility, the rods are divided into parts by over-lapping joints. To preserve its shape, the scrubber would be quilted in several parts like a mackintosh cushion.

The traveller can be used to clean the rudder, but it would be worked on the opposite principle to buoyancy. With brushes fixed inside it, it might be lowered over the stern and made to embrace the rudder, and sink by weights attached to it.—It would be raised, again to sink, and so on; which continued action would soon scrub off the weeds. The stern-way given to the ship would prevent the traveller's flying off.

It is obvious that the more the helm is ported the greater would be the pressure of the brushes against the port side of the rudder, and *vice versa*.

To ships the form of whose run and shallow keel prevent the easy adjustment of the traveller, and to many steamers, a guiding bar (about 1½ in. in diameter, with a flange) might be fixed along the bottom and bow close to the keel, and up the

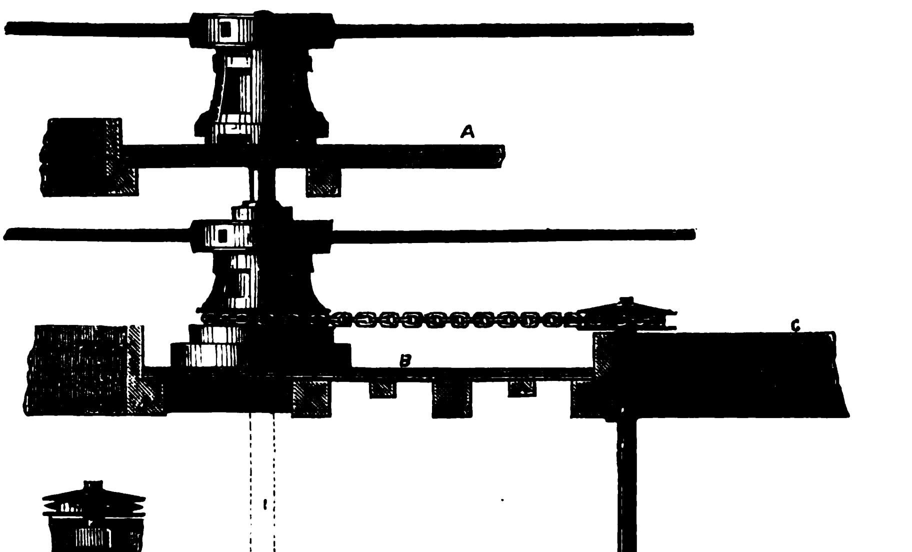
HUTCHINSON'S APPARATUS FOR CLEANING SHIPS' BOTTOMS.



run. On this bar, three or four shackle cringle rings could be made to travel, which rings would virtually become the traveller, and cords would run from them to the scrubber. The keel could be cleaned by one of the scrubbers being passed under it. The scrubber would be retained in position by the rings being hooked to both of its sides. This bar would be kept free from weeds by a close-fitting sharp-edged ring being occasionally run along it. Copper-bottomed vessels would probably have a bar of Muntz's metal.

The accompanying drawings require little explanation. A is the mattress or scrubber, B is the traveller, D ropes and tackle, C cringle ring.

APPARATUS FOR MOVING SCREW STEAMERS IN A CALM.



MOVING SCREW STEAMERS IN A CALM.

Captain M. Conolly, R.N., has suggested certain arrangements for rendering manual power applied to the shafts of screw steamers available for moving them through short distances in calms, &c., when the steam is not up. The plan is a very simple one, and will be easily understood from the accompanying drawing—merely a spindle I down the nearest hatchway to the capstan on the main deck B, connected to the screw shaft by bevel wheels E, and to the capstan by a small length of chain messenger. Or the spindle of the capstan itself may be elongated and brought at once to the screw shaft; but in this case the multiple power would be greatly reduced, and more expense and inconvenience would be attended in its fitting; whereas the plan illustrated may be fitted to any ship, and it is shipped and unshipped in a very few minutes—certainly as soon as the screw could be lowered. We understand that Captain Conolly has submitted his invention to the Admiralty.

AMERICAN COPPER.

We extract the following article on this subject, from the *Scientific American*. It is certain that at no distant day the supply of copper from American sources will materially influence our own markets, and the question is well worthy of attention :—

There was a period in the history of the world when iron was unknown in the arts. The utensils and armour of the most civilized nations in those days were made of bronze—an alloy, composed of copper and tin. After the discovery and application of iron and steel, the use of copper and bronze declined for many purposes; because steel and iron were stronger, and could be produced at a much less cost. No one can over-estimate the value of the general application of iron in the useful arts. But copper is also a most valuable metal, and for some purposes it has no equal. In the art of electro-metallurgy it occupies the front rank as a conductor, and it still forms the chief material of most alloys. For metallic statuary, and brass in all its various forms, it is the principal metal employed, and the demand for it is on the increase. Iron is so subject to corrosion, especially when exposed to a saline atmosphere, or to the action of salt water, that copper is preferred to it as sheathing for ships and for many other purposes, where durability and not strength is the main object. It is also used exclusively for the great pans in sugar refineries, as also the stills in spirit distilleries; and with the increase of all classes of manufactures and chemical products, an increased supply of copper is also required. The copper regions of the United States are of great extent, and the metal of the Lake Superior mines is the best in the world. The present yield of the mines of this region is about 8,000 tons per annum; this amount being twelve times greater than the yield ten years ago. The total annual copper product of the world is about 70,000 tons, Chili supplying 16,000 tons, and Great Britain 17,000 tons; but in the latter country, about 32,000 tons are smelted annually from native and foreign ores, and 25,000 tons of the metal are exported.

The American copper mines are but in their infancy, and their future prospect is cheering; for the ores are perhaps the richest on the globe. Nowhere have such masses of pure copper been found as in the Lake Superior district. And we learn from the *California Farmer*, of the new mines in Calaveras county, in the district called Copperopolis, that the ores of that region are second to none in richness, while they far surpass those of England. Five mines have been opened, which have been worked by skilled Cornish miners, and many thousand tons of ore have been brought to the surface. The best ores are said to yield about 26 per cent. of copper, and one of the mines now forwards about 15 tons of picked ore daily. If copper could be produced at less cost, far more of it would be used in the arts. Attention should, therefore, be directed to improvements in mining and refining this metal so as to reduce its cost. Were it not for its great price, the bronze made of copper and aluminium would be employed for making parts for marine engines, as a substitute for wrought iron, because it is much stronger than that metal, while it is also proof against corrosion by salt or fresh water. In the Newcastle district, England, sulphuric acid is now manufactured in large quantities from sulphurets of copper, instead of the crude sulphur formerly imported from Sicily. After the sulphur is driven off by the heat, the waste or ash is smelted for its copper, and the operation yields a profit, with ash containing only 2 per cent. of metal. Cheap coal is the prime agent for smelting copper ores economically, and this can be obtained in several sections of our country. So far as we have been able to ascertain, there are six copper-smelting establishments in the United States, namely, at Detroit, Mich.: Cleveland, Ohio; Pittsburgh, Pa.; Baltimore, Md.; Boston, Mass.; and New Haven, Conn. This is a large number, considering the short period since copper became an American product of any consequence; but with our great natural resources of rich ores, our smelting establishments should turn out 16,000 instead of 8,000 tons annually, within five years.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—G. S., J. R., J. M., D. and W., J. N., Mr. S., W. W., F. J., R. T. S., C. A. B., K. and Co., A. P. and Co., B. J.

T. K. (Whitehaven.)—We are not certain of the exact day; it was early in March.

A WORKMAN (Peterborough).—In calculating the effective weight of your safety-valve, you must include every portion of the balance, which requires to be raised before the steam can escape. In your case, if you hold the balance upside down, by the rod which fastens it to the boiler, the index will show you on the scale of pounds how much you must add for the balance. The effective weight is probably about 138 lbs.

T. H.—Your suggestion is not a bad one, and seems practicable.

A STUDENT (Leeds).—1. The breaking weight of a bar of wrought iron of good quality, 1 in. square and 1 foot long, supported at each end and loaded in the centre, may be taken at 2,290 lbs. 2. Iron should never be loaded to more than one-fifth of the breaking weight with a quiescent load, or with more than one-tenth if liable to jerks. The limit of elasticity to which you refer depends so much on the quality of the iron and the mode in which the strains are applied, that we cannot give you a general answer within reasonable limits which would be superior to those with which you are already familiar. 3. A beam fixed at one end and loaded at the other will only sustain one-fourth of the load which it would endure if supported at both ends. We shall be happy to solve any particular case if you will submit it in a compact form. You should extend your knowledge of the strength of materials by enlarging your reading, and drawing your own deductions when opinions clash.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

BOILER EXPLOSIONS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The discussion which Mr. Clark has forced upon me is, I fear, directed less to a question of science than to one of good faith and gentlemanly behaviour between ourselves. Within the last month he has for the first time publicly claimed to have given me, in September, 1859, all or nearly all the facts and ideas which I have since advanced in explanation of the violence of boiler explosions. Now I attach but moderate importance to the credit which my reasoning upon this subject may obtain for me; but it is most important for me to escape the discredit which a direct charge of a plagiarism must, if uncontradicted, fix upon me. It is for this reason only, and from no love of controversy, that I distinctly deny Mr. Clark's version of our earlier conversations upon this matter; and I shall endeavour to adduce something like evidence, in a form upon which you, Sir, can decide for or against me. Mr. Clark states that he "started the projectile theory" in a conversation with myself and my friend Mr. Holley, "shortly after" the "Great Eastern" explosion, and that he, Mr. Clark, had first put a "direct question," involving the whole explanation now in dispute, and that neither of us "made any reply." I have referred this statement to Mr. Holley, and the following is his answer, penned without thought of publication, but for which he has since kindly given me full permission.

"3, Pelham-crescent, Hastings, Oct. 1, 1863.

"Dear Colburn,—My recollection of several conversations between us, about the explosion, *before* the meeting in Clark's office, is distinct enough, but what was said I cannot remember. The impression remains distinctly on my mind that you suggested the sudden generation of steam, upon the reduction of pressure by rupture, as the groundwork of the percussive theory of explosions. I also recollect that Clark mentioned the shutting together of the inner wall of the chimney, forming a huge piston, as the cause of the superior upward movement of the explosion. Of course, giving no thought to the speakers, but only to ideas derived on the occasion referred to, I cannot absolutely swear to anything except that my notions on the subject became a consistent theory on the occasion of that conversation in Clark's office. I am certain that Clark did not suggest the theory to me in any private conversation, and I certainly shall not allow the impression to get abroad to that effect.

"Yours truly,
"A. L. HOLLEY."

Mr. Holley had, on the evening of September 10th, 1859, very fully explained to me the construction and working of the "Great Eastern" feed water casing, and, at that time, I presume that none in London, except those who had, with himself, left the ship that day at Portland, could have known the *particulars* of the explosion. My opinion was formed at once, and I expressed it to Mr. Holley. He, listening to me, could not, of course, experience the feeling which a rapid induction and a distinct conclusion of my own left upon my mind, and he naturally, therefore, cannot remember the terms of our conversation quite as distinctly as I do. Now, as to the subsequent conversation in Mr. Clark's office. In my letter to you of the 2nd instant, I did not, as Mr. Clark now assumes, state that this conversation was after September 16th, 1859, but that it was a "few days after" the time, September 10th, when I fully believed Mr. Holley understood and shared my views—a belief which is still nearly justified by his distinct recollection that I, in several conversations *before* our meeting Mr. Clark, "suggested the sudden generation of steam, upon the reduction of pressure by rupture, as the groundwork of the percussive theory of explosions;" although it appears that Mr. Holley's ideas did not acquire the consistency of a complete explanation until after the conversation in Mr. Clark's office, where I stated my veiws at greater length and with many illustrations. This I did because, much to my surprise, as I well recollect, Mr. Clark did not appear to see that which I thought was as clear as noonday. Now, as to the date of this conversation. It could not have been on Sunday, the 11th, and it was not, as Mr. Clark now states, on either Monday or Tuesday, September 12th or 13th. Mr. Clark must well remember that the conversation in question bore very severely upon certain opinions which had been broached in the *Times*, as to the decomposition of steam in the feed water casing, and as to the possibility of an incredible pressure previous to explosion. Mr. Clark, by referring to his file of the *Times*, will find that those opinions appeared on Wednesday, September 14th, and I find by my diary that I did not meet Mr. Clark until Wednesday, and I had then already written so much of my article on the "Great Eastern" disaster as explained the cause of the explosion. This portion of my article, containing the explanation in dispute, was in type when I met Mr. Clark. It was then of the usual length of a "leading article," and I considered it finished. When, however, I saw the *Times* of September 14th, I was strongly tempted to throw aside what was already in type, and to begin at a fresh starting point. I finally, however, decided to extend what I had written, by a criticism of the *Times'* correspondence; and so the article was lengthened to two columns. I distinctly remember this; and the article itself bears almost positive internal evidence of having been written by instalments. I, with Mr. Holley, met Mr. Clark on Wednesday; but no such conversation as he, in his letter to you of the 25th ult., professes to narrate took place. Which of us first commenced to speak I cannot say, nor what "direct questions" were asked; but I entered upon the subject with the feeling of one who has a clearly conceived idea of his own which he is about to impart to another. I was surprised that Mr. Clark did not appear to understand me (nor to understand Mr. Holley either, for he said much in support of my views), and I wondered that Mr. Mr. Clark should speak of a "huge piston," which seemed to be referring the explosion to steadily exerted pressure. I gave my own views at great length, and Mr. Holley did then, at least, fully understand them as a "consistent theory." Not so Mr. Clark. For many weeks afterwards, when I repeatedly went over the same ground with him, he gave no assent to what I said. I was writing all the while upon the subject, and no article of mine, down to November 4, 1859, contained any idea given me by Mr. Clark; nor had he, until then, given me any ideas whatever upon this subject. On the 4th or 5th November, I was in his office again, and he, for the first time, appeared disposed to admit the justness of my explanation. Then it was that he gave me two facts of importance, bearing out my inference that steam acted percussively in a boiler explosion. These facts were the "spring" of the Cornish engine covers, and the jump of the indicator piston above the boiler pressure. I did not know at the time that these very facts had formed the groundwork of a Paper, by Mr. Parkes, on the percussive action of steam, read upwards of 20 years ago before the Institution of Civil Engineers. Both facts were mentioned in the *Engineer* of November 18, 1859, and I gave Mr. Clark credit for both in my tract (p. 44). The evening of November 5, 1859, I spent with Mr. Clark at his lodgings. He then entered fully into my views, and he pointed out why an empty boiler, heated red-hot, could not be exploded by filling it with cold water. So impressed was I with the growing importance of a rational theory of explosions, that I then determined to write a tract upon the whole subject. I had a high respect for Mr. Clark's knowledge of the properties of steam, and for his ability as a writer; and I had the utmost confidence in him as a gentleman. I proposed that he should give me his assistance in preparing the tract—I to write all but the chapter on the "red-hot plate theory"—(not that upon the decomposition of steam). It was important to clear the ground of existing theories, and I felt that Mr. Clark might help me in many ways. He unhesitatingly admitted, as I was quite sure he would, that the percussive theory was mine, and, so far as he and I were concerned, mine only. He as readily assented to having my name over his on the tract, the necessity for which I mentioned to him in order that there might be no misunderstanding. He appeared not only satisfied, but, as I thought, pleased, to share with me whatever credit there might be in the matter. As for myself, it was enough that Mr. Clark was my *friend*. On the 9th November, I again saw him for a few moments; and I said to him that the tract might be larger and costlier than he had counted upon, and that, if he objected to share the expense with me, I would assume the whole myself, of course, without prejudice to our mutual authorship. On the 24th November, 1859, I wrote to Mr. Clark, acknowledging the receipt of a cheque for a sum of money, upon an account between us, and I took occasion to say that I had been too much hurried to begin the tract, but that it should not drop, and I added, in substance, that he had given me nearly all I knew of the action of steam by momentum. Such was the value I placed upon the facts he had given me on the 5th of the same month, for he had contributed absolutely nothing to my many previous articles on explosions in the *Engineer*. Of course, I had no idea that he would afterwards twice print, as he has done in your columns, and without my permission, such an extract from such a note, or I should have been more explicit in my acknowledgment. Time slipped away, and still the tract was not begun. Some time in January, 1860, I observed that Mr. Harman, the then engineer to the Manchester Boiler Association, had adopted my explanation of boiler explosions in his annual report for 1859. Immediately afterwards, I found that Mr. Clark was privately claiming all I had written upon the subject as his own. I at once called upon him, and kindly but earnestly remonstrated with him, and I went over the whole case between us. He heard me out, excused himself from replying, and said we had best discuss the matter in the presence of witnesses. There was nothing, perhaps, objectionable in this, but I own that I did feel hurt that Mr. Clark should propose it. Mr. Holley, the principal "witness," had returned to New York. So I wrote Mr. Clark, appealing to his candour, if I could no longer count upon his friendship. A tedious correspondence was the result, and it ended in his losing his temper, his last letter closing with an oath. In the meantime he wrote the letter which appeared in your columns, February 10th, 1860. He advanced an idea there which had not, I think, up to that time occurred to me, but I cannot even yet quite adopt it, and you, Sir, have already taken exception to it. Such as it was, however, it was Mr. Clark's, and I have always given him full credit for it, transcribing his letter from your columns into my tract. That letter raised no claim to anything in what I had written. In April, 1860, my tract came out, and Mr. Clark was silent. Some months afterwards appeared the 20th volume of the eighth edition of the *Encyclopædia Britannica*. In Mr. Clark's article on the Steam Engine, the percussive theory or "projectile theory" (I think "explanation" a better word) was introduced, and over the initials "D.K.C.," a general credit for materials incorporated in the article was given to the *Engineer* newspaper. In May, 1861, Mr. Clark wrote two letters, which appeared in your columns, in which he insisted that the action of the *water*, as suggested by himself, was "the *only* novel idea in the argument." "The

writer of the articles in the *Engineer*, in 1859," said Mr. Clark "appeared to have had some notion of electrical action in his mind," albeit that Mr. Clark well knew, that of all hypotheses, that of electrical action in boiler explosions found least favour with me. I had repeatedly controverted it, as my writings abundantly show, and in our private conversations Mr. Clark and I had but one opinion upon the matter. In his letters of May, 1861, Mr. Clark ingeniously attempted to show that all which I then claimed and still claim as my own was, not *his*, but Harshman's. This went for nothing with me, for I have by me all, I believe, that Harshman ever wrote upon boiler explosions, and I was perfectly familiar, as early as 1857, with his notions of "polar forces" and "etherial caloric." With this formal ascription to another of all that I have ever claimed in the matter, Mr. Clark rested, until, the other day, finding that the Astronomer Royal had employed the explanation in dispute, he determined boldly to claim the whole for himself. I trust that I have now said enough—I regret that it should have been so much—as to Mr. Clark's share in the origination of the percussive theory of boiler explosions.

I am, Sir,
Your obedient servant,
ZERAH COLBURN.

3, Upper Bedford-place, Russell-square,
Oct. 10, 1863.

P.S.—I send you herewith a volume of the *American Engineer* for 1857, and of which Mr. Holley and myself were the editors and proprietors. You will find in it a number of articles proving how far my mind was prepared to form the present theory of explosions in 1859. I had dwelt strongly upon the distinction between rupture and violent explosions, and also upon the amount of steam which could be disengaged by water previously heated under a pressure greater than that of the atmosphere. Z. C.

Miscellanea.

The Government have seized the two notorious steam-rams which were being built for the slaveholders, and have given the world a guarantee of peace between England and the United States. Why does not the Government go one step further, and seize the builders of the ships, who, in defiance of moral and international law, would, to promote their own interests, endanger the peace between the two great branches of the Anglo-Saxon family?

Since we noticed Hart's metallic fasteners a fortnight since, we have tried them, and found them to be simple, cheap, and useful. Before long we expect to see them as universally used as india-rubber bands. We are not surprised to find that the fasteners are used at all the Government offices, at many of the banks and railway stations, by literary men, architects, lawyers, and others, and that wherever they are used they are highly appreciated.

The number of prize vessels taken into the port of Philadelphia since the beginning of the war is eighty-five. The most valuable, including the cargo, was the steamer "Bermuda," which realized more than half-a-million of dollars. Several of the late prizes, which brought heavy cargoes of cotton, realized large sums.

The Esmeralda *Times*, in speaking of the progress of the work upon the Stanford tunnel, in Aurora, notices the following ingenious expedient for furnishing light for the workmen during the day time:—The tunnel, the most of the day, is worked without using candles. Mr. L. L. Deming, the financial secretary of the company and acting superintendent, has found a more economical light; he uses the sun to work by. The tunnel is so admirably situated, and the cut being so wide, that it enables him, by the use of a mirror, to reflect the full rays of the sun quite into the end where the men are at work, and it is so light that a paper can be read as easily as on the outside. The above tunnel is in about 150 ft., with an open cut at its entrance, quite large in extent and height. Miners in other localities, driving tunnels, will do well to profit by this hint. The light introduced as above, is not only free of cost, but must be infinitely better than that derived from candles.

The Board of Admiralty, with the Controller, and Mr. Reed, Chief Constructor of the Navy, have for some time past had under consideration the necessity of providing a number of efficient gun-vessels to replace the condemned gun-boats at Haslar and other yards, and a design has been agreed upon. The new vessels are to be built of iron and armour plated, and they will be propelled upon the twin-screw principle, which has been proved to be admirably adapted for vessels of this class.

The "Tecumseh," iron-clad monitor battery, was launched from Secor's yard, at Jersey City, on the 12th inst. The vessel is of the new lot of monitors ordered, and has an unusually good model; she is 235 ft. long, 46 ft. beam, 14 ft. deep, and draws 14 ft. of water in fighting trim. She has one turret, and is in other respects similar to all the other ships of her class. Two more batteries are nearly rerdy at this yard.

An American paper says that an engine is now building in New York city for one of the new sloops-of-war. The cylinder is 32 in., and the piston has 8 ft. stroke; it is stated that 100 revolutions per minute are guaranteed; this is equal to a piston speed of 1,600 ft. per minute. When it is considered that 600 ft. is far better than most engines do, it will be seen that quite a novelty is in store for the engineering community. If the time had been stated in seconds instead of minutes, the velocity of the piston would equal that of a Parrot shot.

We hear, says the *Army and Navy Gazette*, that experiments are soon to take place with the Armstrong 600-pounder in firing at a floating target representing a portion of the "Warrior's" side, and that the target built upon Mr. Reed's plan of very thick plates, slight backing, and a two-inch skin, will also, ere long be fired at. We think, therefore, that our naval and military friends interested in these matters should hold themselves in readiness for a run to Shoeburyness in about a fortnight or three weeks from this time.

The *Times* of Monday strongly advocates the introduction of the twin-screw principle into the Navy.

It has become a question of very great importance—"What are we to do to keep our iron ships clean *under water?*" This subject has been well discussed and well tried, but up to the present moment we have nothing *proved* which will keep our iron ships clean for a twelvemonth. Under these circumstances, it becomes absolutely necessary to have the means of cleaning these ships from time to time without the delay and expense of docking, which on some stations abroad is impossible, as dock accommodation does not exist. The result of some experiments tried within the last day or two at Chatham, may lead to the much-desired solution of this difficulty. H.M.S. "Recruit" was, by desire of the Admiralty, partially cleaned whilst at anchor in the Medway, by an apparatus, the invention of Captain H. F. Mackillop, R.N., the principle being simply the application of lime and other substances under water, the action of which whilst slaking is fatal to grass, fish, shell, and all animalculæ. Although we learn that the result has been for the present unsatisfactory, we hope that further improvements may render the process really useful.

Her Majesty's armour-plated screw steam-ram "Valiant," of 34 guns and 800-horse power engines, was launched in a most successful manner on Wednesday afternoon, in the presence of many thousands of spectators, at the Admiralty-yard, Isle of Dogs. The length of the "Valiant" over all is 380 ft.; breadth, extreme, 56 ft. 3 in.; and depth from the spar deck, 39 ft.; burthen, 4,144 tons, builders' measurement. She is a sister ship to the "Hector," which was launched from the Clyde at the close of last year. Within the armour of teak and iron, the "Valiant" is a perfect web of wrought-iron ribs and girders, rendering her, probably, one of the strongest ships afloat. The propelling machinery will consist of a pair of horizontal engines on the double-piston rod principle, manufactured by Messrs. Maudslay and Field. The cylinders are each to be 82 in. diameter, with a stroke of 4 ft. They will both be surrounded with steam jackets, which are supplied with steam direct from the boilers; the ends of the cylinders and the cylinder covers are also to be cast hollow, and supplied with steam in the same manner. The screw propeller is 20 ft. diameter, with two blades, constructed so that the pitch can be varied from 22 ft. 6 in. to 27 ft. 6 in. When working full power the engines are expected to make about 60 revolutions per minute. There will be six boilers, placed three on either side of the vessel, with the stoking-room between them.

Since the commencement of the American war the tin-plate makers of South Wales have gone through a rather severe ordeal, as the United States was one of their principal markets, and in fact the charcoal plate-makers depended almost entirely on that country for their sales. The consequence was that several works were stopped, and many others only partially employed. During the last 12 months, however, there have been indications of returning prosperity, and some of the works that were stopped have again commenced operations, and those that were kept going throughout the depressed times are now more fully employed than before for a long time, and new works are about to be started in different parts of the district. The coke plate from its cheapness and other circumstances has of late commanded a more active demand than the charcoal, and the coke plate works are unusually well employed. The average quotations for I C charcoal are 27s. to 28s. at the works, and I C coke 21s. to 22s.

The Paris correspondent of the BUILDING NEWS, says:—A project is talked of for the formation of a Metropolitan Railway in Paris, similar to that in London. It is to go from the Opera to the Bastille and St. Maudé, and to have stations at the Palais Royal, the central Halles or Markets, and the Hotel de Ville. The line (a single one) from the point of departure will be at the height of a second floor, and by means of aerial bridges traverse the Rues Louis le Grand, d'Antin, Neuve St. Augustin, St. Anne, and Fontaine Molière. From that street to the Rue Richelieu it will make a curve, and be carried to the Palais Royal at the same height. The station at the Palais Royal is to form a gallery parallel with the Galerie d'Orleans. The shops now opening to the garden will form the side. The line is then to pass between the Halle du Blé and the Rue des Deux Ecus to the Halle aux Draps, which is to form the station of the Halles Centrales. The station is to be double. The upper one will be composed of plates receiving each a train, which will be made to descend whilst another train ascends. The trains will thus be instantaneously placed without the necessity of changing places in the subterranean station. The railway is then to continue by a tunnel with two lines by the Rue des Halles, the Rue St. Denis, and the Place du Chatelet. It will emerge under the Quai Lepelletier, and continue on a steep bank. A station will be made under the Pont d'Arcole, opposite the Hotel de Ville.

Consignments of mechanical limbs to Yankeeland form a most imposing item in French shipments to New York. The *Courrier des Etats Unis* notices the brisk sale of human joints, quite outrunning the supply, legs and arms being in particular request, and neatly turned crutches of every pattern being quite at a premium. In the assortment of limbs shippers are put in possession of a very remarkable statistical result. There are, on an average, eight *left* arms and *left* legs required for every *one* of the opposite category; and fighting men may at once account for that fact by the assault of the foe taking effect on the left side, where the right hand of the assailant must be always the most effective.

Encouraging accounts have been received by the Cotton Plantation Company of Natal from their manager in that colony, with two samples of cotton, described and valued by Mr. Pitcairn Campbell, of Liverpool, one as "equal in all respects" to "Good Sea Island," worth 50d. per lb., and the other capable of competing with "Middling Orleans," valued at 27½d. per lb. Under date of July 30, the manager adds that, with the company's own and those employed by contract, there would shortly be at least fifteen ploughs at work; that, what with Caffres, northern Zulus and Coolies, there was no want of labour; and that, with a large area progressively under cultivation, the produce would be on its way to England in July next year.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 622, 635, 637, 668, 669.
BOILERS AND FURNACES, 634, 645, 652.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 627, 643, 650, 651, 656.
SHIPS AND BOATS, including their fittings, 641, 665.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 620, 630.

Food and Beverages, including apparatus for preparing food for men and animals, 648, 667.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 616, 618, 623, 629, 649, 654, 658, 659.
Buildings and Building Materials, 624, 647, 657, 666.
Lighting, Heating, and Ventilating, 626, 632, 638, 663, 664.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 617, 619, 621, 636, 639, 642, 661.
Metals, including apparatus for their manufacture, 625, 640, 644, 646.
Chemistry and Photography, 660.
Electrical Apparatus, 633, 662.
Warfare, 628, 655.
Letter-Press Printing—*none*.
Miscellaneous, 612, 613, 615, 631, 653, 670.

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612. W. Hamilton. *Improvements in means or apparatus for registering, suitable for advertisers' purposes.* Dated March 4, 1863.

This invention consists in arranging and printing, or otherwise exhibiting on board or other surface, the names and titles of the several newspapers or other media for advertising in alphabetical or other order. In juxtaposition to each of these names (it may be in the margin of the board or placard), a series of concentric discs or rings is placed, one of which is inscribed on the surface, and is stationary; the other rotates on an axis. On the stationary ones are inscribed the months of the year, and on each of two inner circles are inscribed numerals corresponding to the days of the month, as in an ordinary calendar, and each reading to 31. On another and inner disc are inscribed the numbers of insertions for advertisements, such as 6, 13, 26, 52, and others. This again is covered by another disc, having a notch cut in it to expose only one number at a time. On the central axis are disposed two hands, like the hands of a clock, or they may project from intermediate axes placed on the same axis. In ordering insertions of advertisements the one hand is turned to the month and date of giving the order or first insertion, and the other is turned to the month and date of expiring or last insertion opposite to each, and all of the names of the papers for which the advertisement is given, and the numbers of insertions at same time exhibited, thus will be seen at a glance the several conditions of all advertisements. *Patent abandoned.*

613. J. Craig. *Improvements in apparatus for detecting and detaining thieves, and indicating the presence of fire.* Dated March 4, 1863.

This invention relates to a peculiar arrangement and combination of apparatus governed by an electric current for detecting the fraudulent tampering with safe or other doors, and for detaining the person so engaged, part of which apparatus also serves as an indicator of fire. *Patent abandoned.*

615. W. Whittle. *Improvements in machinery for the manufacture of nails.* Dated March 5, 1863.

This invention consists—1, of improvements in machinery for heading portions of slit or drawn rods, strips, or wire. In this machine the rods are fed into the machine by a pair of rolls to which an intermittent motion is given by a pull and ratchet wheel worked from the main shaft. The rod fed into the machine is held by a pair of dies, by the motion of which a piece of the required length is cut off against a fixed cutting tool. A heading die advancing against the end of the rod compresses the said end and forms a head. The holding dies ascend with the headed blank in them, and the said dies opening the rod fed into the machine pushes the headed blank from the machine. The feeding rolls and holding dies give a more or less cylindrical figure to the rods or strips when the said rods or strips are angular in cross section. The invention consists—2, of improvements in machinery for grinding points on blanks made by a specially constructed heading machine, or by other heading machines. *Patent completed.*

616. T., E., and R. Thornton. *Improvements in machinery or apparatus for preparing wool or other fibrous substances for spinning.* Dated March 5, 1863.

The first part of this invention consists in having the machine called a "scribbler" provided with cards, similar to the carding engine, so as to produce cardings therefrom; also in the application thereto of ordinary piecing apparatus, so arranged that the cardings may be delivered or fed thereby to the creeper or feed apron of the carding engine; and also in giving a traverse movement to the apparatus employed for tipping the troughs of the piecing apparatus, so as to equalize the feed, and thereby produce more even cardings. The second part of the invention relates to means or apparatus for producing a draught on the cardings as they issue from the piecing apparatus of the carding engine by which the ordinary machine called "billy" is superseded. The apparatus consists of a pair of fluted rollers geared together in a box which is mounted on axes in suitable bearings to allow it to rotate. The axes of the rollers are at right angles to the axes of the box. On one axis or end of the box is fixed a pulley, and on the other end is another pulley which is attached to a bevel wheel capable of running loose thereon. This bevel wheel gears into another bevel wheel fixed on the axis of one of the rollers. This apparatus is placed and arranged so that, whilst the rollers are drawing the cardings, they are also twisting the same, more or less, according as speed is given to the two pulleys by cords, straps, or gear. Nipping rollers are also employed for holding the cardings whilst being drawn. *Patent completed.*

617. J. Clinton. *Improvements in the construction of flutes.* Dated March 5, 1863.

This invention is not described apart from the drawings. *Patent completed.*

618. W. Allen and W. Johnson. *Certain improvements in machinery or apparatus for grinding "cards" employed in carding engines.* Dated March 5, 1863.

This invention relates to the small carding surfaces employed in carding engines generally attached to a continuous chain, and termed "flats," and is designed for the purpose of grinding the surface of such cards in an even and true concave form, or in any other form desired. The improvements consist in the novel employment and use of a guide or peculiar shaped groove to cause the flat to approach and recede from the grinding cylinder at certain intervals, so that such guide governs the superficial form into which the surface of the flat is ground. *Patent completed.*

619. R. D. Dwyer. *Certain improvements in springs to be employed in the manufacture of beds, seats, or for similar purposes, where an elastic surface is required.* Dated March 5, 1863.

This invention consists in the employment and use of two thin laths, bound together at or about the centre of their length by a band of tin, or other confining material, the extreme ends of such laths being forced and retained apart by wedges inserted between them near the central confining band. *Patent abandoned.*

620. E. P. Plenty and W. Pain. *An improved method of supporting screens and straw shakers, specially applicable to thrashing machines.* Dated March 5, 1863.

This invention consists in supporting screens and straw shakers upon springs rigidly fixed at one or both ends, in lieu of the vibrating rods heretofore employed for that purpose. *Patent abandoned.*

621. W. Wells. *Improvements in horse shoes, and in the method of fastening the same.* Dated March 6, 1863.

This invention consists in forming horse shoes without nail holes, and in fastening them to the hoofs of horses by means of two or four projections or hooks from the shoe, which projections or hooks are clamped by a band of iron, or by two bands of iron passing in front of the hoof; in some cases these bands may be tightened by a screw or clamp. *Patent abandoned.*

622. W. J. and R. Watkins. *Improvements in steam engines.* Dated March 5, 1863.

This invention relates, chiefly, to those forms of engines known as direct-acting engines, and whether such engines be vertical, horizontal, or inclined, and whether employed for marine or stationary purposes. Instead of employing a guide back and guides, or any of the usual methods of guiding and supporting the outer end of the piston rod at its junction with the connecting rod, and instead, also, of working a pump by a lever or from off the crank by an eccentric or other means of communicating motion, the patentees effect these two objects of guiding the piston rod and working the pump by placing the pump barrel with its longitudinal axis in or nearly in a line with the cylinder, and between the cylinder and the crank shaft; and they connect the pump plunger or piston to the piston rod, and the end of the connecting rod of the engine by a fork, or any other suitable means; thus the pump is worked direct, and forms also the guide for the piston rod. In condensing engines the air-pump is the pump employed in this manner. The piston or plunger of the pump is of a sufficient diameter to allow of a trunk large enough to permit of the connecting rod vibrating therein, and where the distance between the cylinder end and the crank shaft is limited, as is generally the case in marine engines, they prefer to employ a single-acting and single-trunk pump, the capacity of the pump chamber or barrel being regulated by the dimensions of the annular space, or the difference between the exterior diameter of the trunk and the interior diameter of the pump barrel. In inverted direct-acting screw engines the valves may be placed at the bottom of each pump, in direct communication with the condenser. In every case the connecting rod works within the trunk of a pump placed between the cylinder and the crank, and the cylinder of the pump and the packed end or ends thereof; or the piston and the gland alone are the means of guiding the piston rod, and of taking the thrust due to the angular motion of the connecting rod. For working the back slide or cut-off slide of double slide valve engines, they connect such slide valve to the backward eccentric or its rod directly through a weigh shaft, or by any other of the well-known means, and they regulate the amount of expansion by changing the positions of the slides by means of a screwed valve rod, or other suitable means. *Patent completed.*

623. S. H. Foster, S. Bunney, and J. Anderson. *Improvements in means or apparatus for the manufacture of looped fabrics.* Dated March 5, 1863.

These improvements have for their object to obtain increased facility in the manufacture of what is commonly called "twined work" or "purl work," and rib work, when required. For this purpose, according to the first part of the improvements, the needles are arranged in two sets, and are capable of being separately acted upon in concentric rings. The needles of one ring are arranged radially, and the needles of the other ring are at right angles to them; or they may be inclined thereto. These needles have loose tumblers of the character of those known as Townsend and Moulden's needles, and for which letters patent were granted to M. Townsend and D. Moulden, Feb. 13, 1849 (No. 12,474), and they have short or hooked barbs; and attached to or moving with each of them there is also a spring or pointed instrument, the point of which is curved to enter a recess in the side of its needle, and at a short distance behind the point of this additional instrument there is also a projection or stop. By these means the loops formed on one set of needles may rest on the needles and pointed instruments referred to, and be held there whilst the needles of the other set enter between such pointed instruments and their needles for change of loop. In this adaptation, when it is intended to change from ribbed work to purl work, or purl to ribbed work, the tip of the incline or cam which gives motion to the needles will be raised or depressed at pleasure by means of a jacquard or other suitable selecting means. According to another modification, constituting the second part of the improvements, the needles are arranged in two cylinders, one over the other, and parallel to the axis of such cylinder, with the needles of one cylinder pointing in a direction towards those of the other. These needles also have loose tumblers, and those in the lower cylinder have the upper surfaces of their beards or barbs formed with recesses to receive the ends of the upper needles, whilst in the under side of each of the upper needles there is a recess to receive the point of a lower needle. Threads for loops may be laid on either set of needles as required, and the work is changed from one to the other set of needles by suitable guides. *Patent completed.*

624. J. Miller. *Improvements in horticultural buildings and other glazed structures, part of which improvements are also applicable to ventilating other buildings.* Dated March 5, 1863.

For the purposes of this invention, the heads and sills of the side and end frames are connected together by metal bands or angle iron, and the uprights or mullions are tenoned to these frames; and when either the side or end frames are of considerable length the patentee sometimes forms them in separate parts or sections by dividing them vertically through some of the vertical portions or mullions, and then connecting such divided parts by screws, so that they may be readily separated and reconnected when required. To give strength and stability to such structures, he applies cross stays of iron or wood from the mullions of one side to those of the other, connected by wood screws. The side or end sashes, in place of being hung, are formed in two sets to slide one over or to pass one in front of the other on metal ridges, which are perforated to admit of water collecting between them freely passing away. The overlapping portions, when the sashes are closed, lie behind the uprights or mullions. He also forms the roof in similar parts or sections by division of the main beams, which are in this case attached to the glazed frames. He also, for a span roof, employs two ridge pieces with a space between them for the free passage of air, and he connects these together at intervals. Over these connections, and between the ridge pieces, he applies a stationary plate or board with perforations at intervals, and over this he applies another plate or board, also perforated, and capable of being slidden, so that either the perforated or the plain portions of this sliding-plate or board may come over the perforations of the stationary plate or board. The sliding-plate or board is moved by a lever or other suitable means, and, if desired, there may be two or more of them. Over such perforated plates or boards, and the ridge pieces between which they are placed, and somewhat above them, supported at intervals so as to admit of ventilation, he applies a narrow span roof. *Patent completed.*

625. E. B. Wilson. *An improvement or improvements in the manufacture of steel, and in the apparatus employed therein.* Dated March 5, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

626. T. W. Osborne. *Certain improvements in lamps.* Dated March 5, 1863.

This invention relates to what may be termed hand-lamps, and has for its object—1, to greatly improve the light, and so construct the reservoir that the light shall not be flooded, and thereby extinguished with any undulating or violent motion imparted to the lamp. This the inventor effects by surrounding that part of the wickholder that dips into the oil reservoir with a perforated or woven metal or other ring or tube to break the force of the oil in the body of the lamp when shaken, so that the oil immediately connected with the wick is not disturbed, and, consequently, the light is not flooded, and the oil being supplied by capillary attraction, the light is always brilliant. 2, The object of the invention is to render the working of the lamp, such as the opening and shutting of the door, its attachment to the belt, the removal of the reservoir for dressing and replenishing, as well as the removing and fixing of the screen and ventilator, more simple than the mode hitherto adopted, enabling the user to manipulate his lamp with more facility than such kind of lamps can now be used, and, by providing a lock motion to combine the top and body of the lamp together, prevent the possibility of a mischievous individual extinguishing the light by removing the top or ventilator, and thereby exposing the frame. *Patent abandoned.*

627. J. Howie. *Improvements in the construction of the crossings of railways.* Dated March 5, 1863.

Under one modification or system of arrangement embodied in this invention, in place of laying down rails of the ordinary kind 15 ft. or 16 ft. in length, short lengths of rails are inserted in the main and siding rails at the parts which are found to wear away most rapidly by the traffic of the carriages. The parts which are found to give way so much sooner than the other portions of the line, are those which are contiguous to the tongue or point rails of the crossings. At these parts a comparatively short length of rail is interposed between the line of the ordinary rails, and forming a continuation of the same. These short lengths of rail are, by preference, formed of steel, or case-hardened iron, in order that they may wear as long as the rails which are subjected to the ordinary wear and tear of the line. These short lengths of rail are fastened by means of fish-plates extending for some distance beyond the abutting ends of the rails, and are firmly bolted together. A portion of the bolts may be passed through both the rails, so as to obtain a very firm junction, and prevent all rocking or lateral motion of the rails. The fastening of the parts may, however, be effected in various ways. In conjunction with these short lengths of hard metal rails, it is proposed to make the extremities of the tongue rails in short pieces, fastened by suitable chairs, and extending backwards a length of 4 ft. or 5 ft., and made by preference of steel, or of case-hardened iron, so that these parts may wear in unison with the contiguous hard metal rails. Another mode of arranging the short rails is to form them in two parts, the lower portion of the rail being formed with a vertical web or feather, and the other half being of a saddle-like figure with a recess corresponding to the said mid-feather of the lower part. The upper portion of the rail is slipped on to the lower one,

and the two are firmly secured by being bolted together by the fish-joints. This arrangement admits of the upper portion of the rail being easily renewed from time to time when worn. *Patent completed.*

628. W. Clark. *Improvements in firearms.* (A communication.) Dated March 5, 1863.

This invention relates to an improved revolver pistol which may be divided into four principal parts—1, the barrel, which is slightly rifled, slides on a rod or axis at the under part, to which it is fixed by means of an eccentric; 2, a cylindrical breech; 3, a rotating breech-chamber, intended to receive the projectiles partially fitting in a case enclosing its rear end, and which protects the fulminating points; and, lastly, the stock, which contains the actuating mechanism, and carries the iron pin or axis before mentioned, serving to connect the principal parts together, and an eccentric groove for connecting the barrel thereto. The butt has a ring for attaching the pistol to the body, while the action is double, and is effected simply by cocking the hammer and then pressing the finger on the trigger. The two principal parts may be detached or connected together by hand by means of a simple arrangement, and without the aid of any instrument. *Patent completed.*

629. J. Elsey. *Improved apparatus for the winding of lace on to the work roller in warp lace, bobbin net, or twist lace machines.* Dated March 5, 1863.

This invention relates to apparatus for the winding of lace on to the work roller in warp lace, bobbin net, or twist lace machines. Heretofore, in such machines, as the diameter of the roll of lace or fabric wound on the work roller progressively increased, what is called the "take-up" of the work also increased, so that the end of the lace last made was longer than the portion first made, although there was an equal number of motions at each end. By means of this improved apparatus the lace or fabric is wound on the work roller as fast as produced on the machine, and at a certain and regular speed, whereby the lace or fabric is of the same length throughout, and without variation in respect of the tightness or slackness of the lace or fabric when made. *Patent completed.*

630. C. Clay. *Improvements in chain harrows.* Dated March 5, 1863.

In constructing chain harrows according to this invention, each row of links which passes transversely across the harrow is composed of alternate links of cast iron, or malleable cast iron, and of wrought-iron links, which connect together the links of moveable cast iron. The cast links are made with holes—by preference oval-shaped holes—through them on two opposite sides of the link, and the wrought-iron links pass through these holes. The wrought-iron links are, by preference, formed with notches on their opposite sides, into which notches the cast links fit; the wrought-iron links will thus always keep the cast-iron links at the proper distance apart, so that each row of links may be kept properly extended. The rows of links are connected together by the wrought-iron links of each row being connected to the wrought-iron links of the next row, either by plain links or wrought iron, or by links formed with holes through them on two opposite sides, as described. The chain harrow is connected to its whipple-tree by rods or chains passing from the whipple-tree to the wrought-iron links of the front row of links of the harrow. *Patent abandoned.*

631. J. Morris and T. Newton. *An improvement or improvements in refrigerators and other like articles.* Dated March 5, 1863.

The top of this improved refrigerator is divided into three compartments, that in the centre being intended for the ice well, and those at the sides to contain wine, water, or other liquid to be cooled, to which cooler taps are applied. The waste water from the ice well is conveyed to a cistern beneath another ice well at the bottom of the refrigerator by means of wide, flat, or other suitably-shaped channels formed in the back and sides. The top, sides, and back are packed with a packing consisting of burnt cork, charcoal dust, or other like suitable material. The rim of the lid when closed falls into a small channel filled with water, which keeps the ice well air-tight. A lower ice well extends over the whole bottom of the refrigerator, from which the waste water is conveyed to the cistern immediately beneath, from which it is withdrawn by means of a tap. By forming the channels for conveying the waste water from the upper ice well in the back and sides, and having an ice well at the bottom, the usual central division is entirely dispensed with, thereby obtaining increased space in the interior thereof, and effecting a saving of at least 100 per cent. in the consumption of ice. The patentees make the ice chests, refrigerators, and other like articles portable, and of any size or shape, and entirely of zinc, galvanized iron, or other suitable metals, thereby dispensing with the wooden casing as at present used, and which is well known not only to attract the heat but to retain it. *Patent completed.*

632. W. H. Buckland. *Improvements in the mode of, and in the apparatus for, producing gas for illuminating and heating purposes, parts of which improvements are also applicable for increasing the illuminating and heating power of ordinary lighting gas.* Dated March 5, 1863.

This invention consists in carburetting air or gas by causing it to pass over the surface or through woven fabrics or fibrous or spongy substances which have the property of sucking up and exposing the liquid hydro-carbon in a finely divided state. *Patent completed.*

633. M. Jourdin. *Improvements in machinery for engraving by means of electricity.* Dated March 6, 1863.

This invention is carried out as follows:—The pattern intended to be reproduced is first engraved by hand, or by any other process, at least four times larger than the engraved plate required. This pattern plate is fitted up with an insulating material, and it is adjusted on a frame connected with the machine. In front of this plate, thus prepared and adjusted to the frame, is placed a small metallic point, made slightly to press upon it, and in communication with one of the poles of an electric battery. On another frame is adjusted the metallic plate, or any other object to be engraved, such as watch cases, dials, jewellery, or other articles. In front of this is placed a small graver, pressing on the article to be engraved, or being pulled from it, through the medium of an electric magnet. Both of these frames are always turning during the operation; but the metallic point in front of the pattern frame and the graver in front of the other frame are both susceptible of moving in a longitudinal direction, but do not advance with the same speed, their speed depending on the relation between the size of the pattern plate and the plate to be engraved. This motion is obtained by the use of two wheels placed, the one with the slide supporting the point in front of the pattern, the other with the slide supporting the reproducing graver. *Patent abandoned.*

634. A. Cuthell. *Improvements in self-acting dampers for steam-engine furnaces.* Dated March 6, 1863.

This invention consists in certain arrangements of mechanism whereby the dampers of steam-engine furnaces are actuated and regulated in a self-acting manner, and constituting an improvement upon what is generally known as the cylinder and lever principle. In carrying the invention into effect, an equilibrium valve is placed in any convenient position between the boiler and cylinder, the same being in connection with the steam pipe, and capable of being adjusted to any required pressure by means of springs or weights. A piston working in a cylinder, or some other analogous contrivance, is employed, the water being placed so as effectually to close the communication between the boiler and the last-mentioned cylinder and piston until the pressure of the steam in the boiler is above that at which the valve has been adjusted. The damper is connected with the piston by means of suitable rods or gearing, such as will be well understood by persons conversant with the construction of steam machinery. Upon the pressure of the steam in the boiler overcoming the resistance of the valve, the latter is actuated, and the steam, being allowed to enter the before-mentioned cylinder, the piston consequently rises, and the damper is lowered by the upward motion of the piston. The valve being upon the equilibrium principle, is not affected by the pressure of the steam in the contrary direction after passing it, and the valve will, consequently, act freely under any variation of pressure in the boiler. The escape of steam from the cylinder may be effected by the action of the valve in shutting off the communication between the boiler and the cylinder, or by a small aperture at the bottom of the cylinder, so constructed as to let off the steam gradually, and which aperture may be kept constantly open. *Patent completed.*

635. A. W. Makinson. *Improvements in locomotive and stationary engines.* Dated March 6, 1863.

This invention is an improvement on a patent granted to the present patentee, dated June 17, 1862 (No. 1789), in which he described the end of the connecting rod as describing an ellipse round the driving axle, instead of a circle, by being attached to a pin working in a slot in the crank arm, which pin had its motion in the slot regulated or constrained by guides. He now finds that, by lengthening the connecting rod so as to extend beyond the driving wheel, and attaching it to a disc or crank arm revolving on a stud, or in bearings fixed in any convenient part of the frame, he can secure the motion of the crank pin of the driving axle in an ellipse in a more simple and efficient manner than by the use of guides. *Patent completed.*

636. A. Wilson. *The better and more commodious manufacture of all kinds of easy, lounging, and invalid chairs, seats, or settees.* Dated March 6, 1863.

This invention consists in the application of hammered or tempered steel, iron, vulcanized india rubber, or any other kind of accumulative spring or springs, that may be placed or fixed in or upon such parts or positions as may be best suited to the forms and fashions of the various chairs, chaises, seats, or settees that may be desired or sought to be accumulative, elastic, self-acting, and self-recovering. *Patent completed.*

637. W. E. Gedge. *Improvements in steam engines.* (A communication.) Dated March 6, 1863.

This invention is not described apart from the drawings. *Patent completed.*

638. G. T. Bousfield. *Improvements in the manufacture of illuminating gas, and in apparatus employed therein.* (A communication.) Dated March 6, 1863.

The first part of this invention consists in the process of decomposing the fluid hydro-carbons (whether fluid at the ordinary temperatures, or rendered fluid by preliminary heating or solution in a liquid hydro-carbon) in the presence of hydrogen previously prepared for the purpose, the hydrogen being supplied in the proper relative quantity to combine to form olefiant gas with the products of the decomposition of the hydro-carbons. The second part of the invention consists in an apparatus for performing the above process, which apparatus consists, substantially, of the combination of the following devices, viz.—1, a retort in which water is decomposed to furnish hydrogen; 2, a retort in which a fluid hydro-carbon is decomposed by heat; 3, one or more furnaces for heating the retorts to the required temperatures; 4, apparatus to supply water in regulated quantities to the retort in which it is decomposed, whether such water be supplied in liquid form or in the form of steam; 5, apparatus to supply a fluid hydro-carbon in regulated quantities to the retort in which it is decomposed; 6, a connecting pipe to conduct the hydrogen from the retort in which it is formed to the retort in which the fluid hydro-carbon is decomposed. The third part of the invention consists in the employment of zinc in the retort in which water is to be decomposed, in connection with the second part of the invention, so that the oxygen of the water shall combine with the zinc to form an oxide of zinc, and that illuminating gas and oxide of zinc shall be products of the operation. The fourth part of the invention consists in the combination of the retort for the decomposition of water with the retort for the formation of the illuminating gas through the intervention of a condenser, so that such zinc or other substance as may pass off with the hydrogen may be separated from it previous to the introduction of the hydrogen into the retort in which the formation of illuminating gas is to take place. The fifth part of the invention consists in the combination of a heating apparatus with the second part of the invention for the purpose of heating steam previous to its decomposition. The sixth part of the invention consists in the combination of a heating apparatus with the second part of the invention for the purpose of reheating the hydrogen previous to its introduction into the retort in which the illuminating gas is to be formed. *Patent completed.*

639. D. W. Ransom. *Improvements in fixing artificial teeth.* Dated March 6, 1863.

This invention is applicable when fixing teeth in vulcanite or like mounted bases. Artificial teeth have before been made with metal pins, which have usually been bent in opposite directions, in order that when the base of vulcanite or other suitably formed base has been constructed and rendered hard, the teeth may be held securely to the base. This mode of applying pins has not, however, been free from objection. According to this invention, the patentee forms the pins, or it may be a single pin, with a screw thread or threads thereon, or with notches; if two or more pins are applied to a tooth, they may be arranged parallel to each other, but he prefers that they should incline away from each other. *Patent completed.*

640. T. Hancock. *An improved receptacle for gold and silver or other coins.* Dated March 6, 1863.

This improved receptacle may be made in the form of a cash box or other form, and consists of two halves or parts, the line of the junction of which lies across the centre of the coins to be deposited therein. Each such half or part of the receptacle is divided into any number of divisions, in such manner that one or more of such divisions, say, the divisions in the lower half or part, is of such a length that each division may contain a desired number of sovereigns, or other coins, say, by way of example, 5 sovereigns or a proportionate number of half-sovereigns or other coins; a number of other divisions are of such length that 10, 15, 20, or other required or determined number of coins may be put in each such division, which said divisions the patentee sometimes provides with a metal, india-rubber, or other spring. These divisions are of precisely such length that only the intended number of coins can be placed therein. There are also other divisions for receiving loose coins or uncounted change; and in order that the divisions may allow of new or old coins being placed within them, an end of each division or separate compartment may be slightly moveable endwise, but only to the extent of the difference that may exist between, 5, 10, 15, 20, or any other number of new, old, or worn coins. Between the moveable end of one division or separate compartment and the fixed end of the next compartment he places a metal, india-rubber, or other spring. He makes the whole receptacle of wood, metal, papier mache, or other convenient material. When the upper part or half of the receptacle is closed down upon the lower half or part, and secured thereto by locking or otherwise, none of the coins therein (except the loose change or uncounted coins in their division or compartment before mentioned) can be shaken loose or displaced, the upper half of the receptacle being an exact counterpart of the lower end. *Patent completed.*

641. H. R. Spicer. *Improvements in protecting and preserving the bottoms and sides of ships and other submerged surfaces from oxidation or fouling by incrustation, the attachment of barnacles, the action of animalculæ, or from any other like causes of injury.* Dated March 6, 1863.

For the purposes of this invention, the inventor employs sheets, plates, or tiles of glass, china, or porcelain, of such size and thickness as may be most suitable to the surface to be covered. He attaches the said sheets, plates, or tiles of glass, china, or porcelain, to the surfaces to be covered by cementing mediums, such as red lead, putty, bituminous or resinous cements, or mechanical means, such as screws, nails, or pegs formed partly or entirely of metal or glass, or by the employment of flanges, dogs, or clips formed by the configuration of the said sheets, plates, or tiles. *Patent abandoned.*

642. T. G. Webb. *Improvements in the manufacture of articles of pressed glass.* Dated March 6, 1863.

This invention relates to those articles of compressed glass which are provided with handles, such as custard cups, and a variety of others, and consists in forming such handles (which are usually hollow) with a mid-feather uniting the outward part of the handle to the body of the article. By this means the patentee is enabled to secure greater strength, and to avoid that roughness which exists in such handles made after the ordinary manner, and without losing the appearance of lightness existing in hollow handles. *Patent abandoned.*

643. A. V. Newton. *An improved construction of elastic carriage wheel.* (A communication.) Dated March 6, 1863.

The patentee claims rendering a carriage wheel elastic by making the felloe in two concentric parts, and interposing a belt or layer of india rubber or other elastic material substantially, as described. *Patent completed.*

644. W. E. Newton. *Improvements in the construction of metal casks, and in the machinery employed in the manufacture thereof.* (A communication.) Dated March 6, 1863.

This invention consists in the manufacture of such casks of sheet iron, and of cylindrical form, having their external convex surfaces formed with circumferential corrugations, extending in a continuous series from one chine thereof to the other, in such a manner that the salient corrugations of one cask shall fit the re-entering corrugations of another of the same pattern arranged side by side with and close to it, so that a rank or tier of such casks shall interlock firmly with each other, and pack closely together, and so facilitate their stowage on board ship or elsewhere. The invention further consists in the insertion within a cask, having its exterior formed of sheet metal, corrugated as above specified, of a plain internal or lining cylinder, made to fit snugly and tightly to the internal cylinder, and secured thereto at the chine. Also in the manufacture of a cask of sheet metal

with its heads sufficiently concave externally, and convex internally, to prevent them from being bent outward by the internal pressure of the fluid that may be contained therein, and with flanges bent at nearly right angles to their respective surfaces, and so shaped as to be readily fitted and rivetted, or otherwise secured, to the chines of the cask. The invention further consists in the construction of the head of a sheet-metal cask of the flanged concavo-convex form above specified, of a diameter larger than the interior of the chine of the cask, and in combination with this a groove or corrugation is made in the chine, so that when the head is sprung into the cask, it shall find a firm shoulder, and make a closer joint when any pressure is brought against its interior. Another improvement consists in strengthening the chines of sheet-metal casks by shrinking metal hoops upon their exteriors, such hoops, by being rivetted through the chines, also aiding to secure the heads in their place. Another improvement consists in the use of a double hoop, so constructed and applied as to lap over the chine of a sheet-metal cask, and surround the exterior of the chine, as well as to line the flange of the head. These metal hoops are rivetted through the chine and flange, thus serving both to strengthen the chine and to aid in securing the head. The construction of the bung-hole constitutes the next improvement as applied to a cylindrical corrugated cask, with inside and outside supporting rings or cheeks fitted to the corrugations of the body of the cask, and attached together by bolts or otherwise. The bung of the cylindrical sheet-metal cask having its bung-hole in its perispherical surface, is so constructed that it will be somewhat depressed beneath the outside supporting ring or cheeks surrounding the hole, and be thereby protected by such ring or cheeks when the cask is rolled over an even surface. *Patent completed.*

645. H. Whittles. *Improvements in machinery and apparatus for collecting the condensed steam or waste water from places where steam is used, and returning the same to the boiler.* Dated March 9, 1863.

In carrying out this invention, the inventor causes the waste steam to be passed through one or more pipes (and valves adapted to the pressure) to a compound box or chamber, having in it a float attached by a rod and chain or cord to a balance wheel, to which is fixed one or more pins or tumblers. The top of the compound box is connected by a pipe with the steam part of the boiler, and the pipe is provided with a tap for opening and closing the communication, which tap is connected to a lever in contact with another lever, capable of being acted upon by the pins or tumblers on the balance wheel. At the bottom of the compound box there is a pipe and valve communicating with the lower part of the boiler. As the water from the waste steam collects in the compound box, the float rises and turns the balance wheel, which causes one of the pins or tumblers to act upon the levers, and open the tap in the upper part, and form a communication between the boiler and compound box, and allow steam from the boiler to press upon the water collected in the compound box, and force it through the lower pipe into the lower part of the boiler, and thereby empty the contents of the box into the boiler. *Patent abandoned.*

646. R. Mushet. *An improvement in the manufacture or treatment of pig or cast iron.* Dated March 9, 1863.

The essence of this invention consists in mixing and combining with melted pig or cast iron, which it is intended to form into castings, a quantity of melted steel, semi-steel, or malleable iron, which said melted steel, semi-steel, or malleable iron has been obtained by refining or decarbonizing melted pig or cast iron by the pneumatic process, or melted steel, semi-steel, or melted malleable iron prepared by processes other than the pneumatic, in order by this admixture and combination to strengthen and improve the quality of the said pig iron or cast iron.

647. J. Cowley. *Improvements in machinery or apparatus for manufacturing bricks, tiles, pipes, and mouldings.* Dated March 9, 1863.

This invention relates to a peculiar arrangement, construction, and combination of machinery or apparatus for moulded bricks, brick mouldings, perforated bricks, tiles, and drain pipes, whereby less power is required to actuate the machine, and a smaller proportion of water employed than in the ordinary methods of brick making. According to this invention, a hopper and pug mill, with a receiving box and piston, are employed in combination with a mould box, which is also provided with a piston of its own. The clay, which may be taken direct from the bank, is placed in the hopper and prepared and well worked by the knives of the pug mill, which also force it down into the receiving box, from whence it is forced by a piston or plunger into the mould. If a perforated or partially perforated or recessed brick is required, this mould box is provided with cores of greater or less length to produce the perforations or indentations intended to be produced. From this mould the brick thus moulded and pressed is expelled by piston working therein, and is received on to an endless travelling web which carries it clear of the machine. In making tiles and pipes the brick mould is removed and replaced by the required mould or die to suit the article to be manufactured. *Patent completed.*

648. H. A. Bonneville. *A new aromatic vinegar for removing stains from cloth and other materials.* (A communication.) Dated March 9, 1863.

The patentee claims the use of the ethers, amyl-acetic, ethyl-acetic, and methyl-acetic, as base of a new aromatic, and at the same time, hygienic vinegar, which may be used for removing stains from stuffs of all kinds, without altering their shades, whether employed alone or mixed together in equal parts, dissolved or not dissolved, in absolute alcohol acidulated with acetic acid for the purpose of reviving certain colours, or aromatized by the addition of certain perfumes. *Patent completed.*

649. J. Isherwood. *Improvements in working presses for making up yarn in bundles.* Dated March 9, 1863.

This invention consists in giving the requisite pressure to the yarn by the direct action of hydraulic power or steam. In performing the invention, a ram is attached to the follower of the press, and this ram fits in a cylinder in communication with the water or steam pipe, which is furnished with inlet and outlet valves, either in equilibrium or otherwise. When the yarn to be pressed is placed on the follower, and the top and sides of the press are secured in the usual manner, water or steam is admitted to the cylinder, and the follower is gradually raised until the yarn is sufficiently compressed; a self-acting or other stop connected with the follower then comes into operation, and by closing the inlet valve shuts off the water or steam by which the follower is raised. The bundle of yarn is then corded in the usual manner, and the outlet valve is opened to allow the follower to descend for the subsequent operation. *Patent completed.*

650. J. Haworth. *Improvements in breaks for omnibuses and other carriages.* Dated March 9, 1863.

This invention consists in applying a metal clip lined with leather or other suitable material for increasing the friction to the nave of one or more of the wheels of an omnibus or other carriage, and in connecting the two ends of the clip to a double lever which is in communication with a treadle or handle. *Patent abandoned.*

651. C. H. Lea. *Improved apparatus for opening and closing the gates of railway crossings, which apparatus also acts simultaneously upon the signals.* Dated March 9, 1863.

This invention is designed for the purpose of preventing accidents at level crossings, and to enable one person by a simple movement of a lever to open or close both gates, and at the same time to set the signals on both the up and down lines of the railway. At places where a railway crosses a common road at about right angles, it is usual to have two pairs of gates, so arranged as that when they are open as regards the road, they are closed as regards the railway, and *vice versa.* The patentee mounts these gates so as to turn upon footsteps, and connects each gate by a link to the outer end of a lever capable of vibrating on a fixed centre. The inner ends of each pair of levers meet in the centre, and are furnished with slotted eyes, and they are all four connected together by rods and links running along the six foot way, so that they must all act simultaneously. The outer end of one of the levers is lengthened, and is connected by a chain or chains to two hand levers, one of which being depressed causes the gates to open simultaneously, and the other closes them in a similar manner. By connecting the ordinary semaphore or other signals on the up and down lines which work the gates by means of chains passing round pulleys, the opening of the gates (or closing of them as regards the railway) will be caused to raise the danger signals on both lines, a spring or weight bringing the same down as soon as released by the closing of the gates to the road. *Patent completed.*

652. W. Inglis. *Improvements in steam boilers and engines.* Dated March 9, 1863.

This invention is not described apart from the drawings. *Patent completed.*

653. P. Hugon. *Improved machinery for obtaining and applying motive power.* Dated March 9, 1863.

This invention is based upon the indirect action of an explosive mixture upon the piston of an engine by means of an intermediate column of water which is exhausted by the vacuum which the explosion produces in the generating tubes; the characteristic features of the invention are—1, the substitution of the indirect action of the exploded mixture for the direct action which takes place in ordinary gas engines; 2, the indrect action of the explosive power upon the piston rod, through an intermediate column of water, on the surface of which the mixture of air and gas is exploded; 3, the inflaming of the mixture of air and gas in a tube of the receiver separated from the engine cylinder; the vacuum produced in a space separated from the cylinder determines the to-and-fro movement of the piston; 4, the constant circulation of the same water in the machine; and 5, the presence of water in every part of the machine for the better utilization of the vacuum. *Patent completed.*

654. A. Keller. *An improved apparatus for reeling silk direct from cocoons or bobbins.* March 9, 1863.

For the purposes of this invention, an apparatus is combined in the following manner, and by preference each combined apparatus is arranged to reel with six sets of cocoons at the same time, but apparatus may be similarly arranged to reel with other number of sets of cocoons. The apparatus is further arranged in pairs, so that on the breaking of any of the fibres only one pair may be stopped in order to piece up the broken fibres. The cocoons are placed in a basin containing water, which is kept heated by a steam pipe. The desired number of filaments of silk, from as many cocoons, are compacted together by an apparatus as the filaments rise towards a reel, on to which the compacted filaments are continuously wound, so as to take some turns on the reel, and at the same time such compacted filaments are unwound or delivered from the reel to the cylinder, which is either of smaller diameter than the reel, or moving with a less surface speed, so as to allow the filaments of silk to shrink before they are wound on to a bobbin. The cylinder is placed within a case or chamber, which is supplied with heated or dry air, and there is a steam pipe within the chamber to heat the same. The bobbin on to which the compacted fibres are wound is in surface contact with the cylinder, and is caused to rotate thereby. The compacted filaments are spread evenly on the bobbin when being wound thereon. *Patent completed.*

655. W. J. Clapp and N. Coats. *Improved armour plates for vessels, turrets, targets, forts, and other structures in which armour plates are or may be used.* Dated March 9, 1863.

The patentees employ plates of iron, or other suitable metal, with curved and with flat portions, and through the flat portions they pass bolts or rivets to secure the same to the framing of the vessel, turret, target, fort, or structure, in such manner that other curved plates may be placed over the said flat portions of the first mentioned plates, and over the joints thereof, to cover and protect such bolts or rivets first mentioned, the last mentioned curved plates being bolted or rivetted through the first mentioned cor[illegible] plates, or otherwise, or secured in any equivalent manner. By these means additional strength is obtained, and the principal, and if desired, the major, part of the joints and bolts or rivet heads is protected, so that a single plate shall not receive all the force of any projectile or striking body, but such force be distributed over the whole of the plates, thereby rendering them impregnable if constructed of proper thickness. The plates should be produced by rolling or compressing. *Patent completed.*

656. J. R. Gorst. *Improvements in carriages.* March [illegible], 1863.

This invention has for its object the construction of carriages in such a manner as to facilitate their draft by the use of wheels of increased diameter, and to admit of the centre of gravity of the carriage being lower than usual. For this purpose the shank of the axletree is lengthened, as required, and is made to form (either with or without the aid of a pieced crank) a fixed vertical guide for a grooved slide, which carries a box in which the upper part of the said shank is enclosed, in such a manner as to give stability to the said shank, and prevent the box and slide from moving thereon in any but a vertical direction to an extent limited by the length of the slot in the box, and the fixed stops. The upper part of the shank of the axletree, where the axle is inserted, is strengthened by two side pieces, which fit the hollow space in the box, and are brought in contact with the said fixed stops as the box is pressed upwards to its extreme height by the springs, or downwards by the weight on the body of the carriage. At the lower end of the shank of the axletree there is a cross-piece or crutch, to which is or are fixed a spring or springs, and which extend to a corresponding cross-piece or crutch at the bottom of the shank on the opposite side of the carriage. This spring or springs is or are intended to take the smaller weight—that is to say, the weight of the unloaded carriage, and there are two side springs (one on each side of the carriage) fixed at their ends to the body of the carriage, and bolted in the middle to a cross-piece fixed on to the shank of the axletree, which springs are intended to take any greater weight put upon the carriage. Or there may be two springs on each side fixed between the bottom plate of the said box and the said cross-piece for the same purpose. *Patent completed.*

657. W. E. Newton. *Improvements in the construction or laying of wooden floors.* (A communication.) Dated March 9, 1863.

This invention relates to that description of floor in which pieces of wood of suitable shape, colours, or dimensions are arranged as a flooring in any convenient manner, to produce a kind of pattern or design. The invention consists of a cheap and novel mode of securing the pieces of wood. In carrying out the invention, the ground on which the floor is to be laid must be well rammed down and made quite flat. Laths or battens are then laid thereon at suitable distances apart, according to the circumstances of the case, the laths or battens being of course laid transversely to the direction in which the flooring boards are to be placed. The ground, with the laths or battens thereon, is then covered with a layer of hot bitumen, asphalte, or other suitable mastic or preparation, and then the pieces of wood which are to form the flooring are placed thereon with their edges well fitted together. In order to cause the pieces of the wood to be held securely, they should be grooved on their under sides, so that the softened bitumen or asphalto may enter therein, and hold them down firmly from behind. *Patent completed.*

658. J. H. Johnson. *Improvements in the treatment of certain fibrous vegetable substances with a view to the production of textile materials therefrom.* (A communication.) Dated March 9, 1863.

According to this invention, it is proposed to employ the fibres of the agave or aloe, layetta linteana, hemp, flax, sossage manilla, jute, and the fibrous portions of the wild pine-apple plant, and to treat them either separately or together in the following way:—The fibrous vegetable substances having been first dried, are then subjected to a macerating process under edge wheels, stones, or rollers, grooved or plain, in order to render the fibres soft and flexible. These fibres are then to be placed in a vat containing just sufficient hot water to cover them, and to 1,000 parts by weight of fibre are added 6 parts by weight of chloride of lime, or its equivalent proportion of bleaching liquid, or chloride of soda, and 6 parts by weight of sulphuric acid of commerce. The fibres are now allowed to macerate, the chemical action being assisted if desired by the application of heat. When the fibres are removed from the vat, care is to be taken to protect them as much as possible from contact with the atmosphere, and they are then washed either in running water, or in suitable vessels. The same chemical bath may be employed for more than one operation. Finally, the partially prepared fibres are dried, combed, and carded, and otherwise treated after the manner of treating cotton for the manufacture of textile fabrics. *Patent completed.*

659. H. Fletcher. *Improvements in cleaning and preparing cotton for spinning.* Dated March 11, 1863.

In carrying out this invention, the inventor makes a cotton gin suitable for poor emigrants, ryots, and small cultivators, by using a light iron stand cast in one piece (adapted to sewing machines, as described in the specification of patent 1784, dated August 2, 1859). He uses metal rollers and large gearing on both sides of the frame. An idle wheel on one side changes the direction, and gives increased speed, if used as a driver. An extra roller above and below the working rollers strengthens them. The same or a differential velocity is given to the rollers by the relative proportions of the gearing. Pressure is got by india-rubber weights, springs, or other means commonly used to obtain elastic force. Diaphragms above and below the rollers prevent overlapping and separate the fibre and seeds from the rollers. The fluted gearing of the Indian churka made of metal may be used instead of both sides gearing. He uses metal instead of leather for the rollers in the gins commonly called McCarthy gins. The light iron frame before referred to will do for these gins. *Patent abandoned.*

660. R. T. and R. MONTEITH. *Improvements in making dyes from aniline and its analogues.* (A communication.) Dated March 11, 1863.

This invention is carried out as follows:—Aniline red—a substance well known in commerce, and which is made from aniline or one of its analogues—is mixed with a dry salt of aniline, or one of its analogues, and heated in a suitable vessel, either hermetically closed, or not, to a temperature of 390 deg. Fahr., and upwards, for as long a time as may be necessary to form the dye of the required shade. This will be from one to six hours. The dyes thus produced are shades of brown called in France "Cairs" and "Havanne." The brown dye thus formed may be separated into two brown dyes of different shades, a part being soluble in boiling water, and nearly all the rest in alcohol. The mass which results from heating the aniline red and the dry salt of aniline must, therefore, be treated with a sufficient quantity of boiling water to dissolve out all that is soluble in it, and then filtered, and the residue treated with alcohol and filtered. Both filtrates will dry brown, but of different shades. These dyes may be used at once for dyeing textile fabrics and yarns, or they can be purified by any of the methods in general use for purifying aniline colours before dyeing with them. *Patent completed.*

661. F. COOKE. *Certain improvements in the manufacture of hats or coverings for the head.* Dated March 11, 1863.

This invention relates to the manufacture of such hats or coverings for the head as are made of felt or similar material, and also to the manufacture of that portion of hats called the hat body, which is generally composed of woven fabric and varnish, and subsequently covered with plush. The invention is designed to produce a sharp angular and well-defined edge at the junction of the crown with the sides, and consists in the employment and use of an india-rubber or other elastic "crown core," formed with an angle corresponding to the mould in which the hat is made. This core is fitted into the crown of the hat or body when in a pliable state, and pressure is applied thereto either by means of water, as at present used in making felt hats, or by other convenient means. By this pressure the india-rubber core is caused to expand and press the felt or other material into the angle of the exterior mould, and produce an angular junction between the sides and the crown of the hat, instead of such edge being rounded as hitherto. *Patent abandoned.*

662. R. A. BROOMAN. *Improvements in voltaic belts and bandages.* (A communication). Dated March 11, 1863.

This invention consists in constructing belts and bandages composed of a bi-metallic core, consisting of plates, strips, or blades of metal one electro-positive to the other, such as copper and zinc, forming a voltaic battery, juxtaposed or placed one against the other, and covered with some fabric or material which will keep them in place, and to which buckles, tapes, or other means of fastening are applied to secure them to any desired part of the body. The plates, strips, or blades may be of any form, according to the part to which they are to be applied. The moisture of the body will generally suffice to excite the bandages to action. In some cases, however, they may be excited b vinegar or diluted acid more or less strong. *Patent abandoned.*

663. J. CASSELL. *Improvements in moderator lamps to adapt them to the burning of petroleum and other mineral oils and hydro-carbons.* (A communication). Dated March 11, 1863.

This invention is not described apart from the drawings. *Patent completed.*

664. G. A. FULTON and J. CLYDE. *Improvements in dry gas meters.* Dated March 11, 1863.

The main object of this invention is to adapt dry gas meters to the foot or base of the pillars or columns of street lamps; and the invention consists in forming an inlet aperture in the bottom or lower part of the gas chamber, and in connecting the supply pipe directly therewith, so that the gas may enter at once into the gas chamber. The inventors form the outlet from the top and centre of the meter case. *Patent abandoned.*

665. W. R. MULLEY. *Improvements in sheathing iron ships, caissons, and other like structures.* Dated March 11, 1863.

This invention consists in attaching metal sheathing to iron ships' bottoms, caissons, and other like structures as hereafter described. The patentee takes two pieces of angle iron with J on one edge. He prefers the iron to be 3-16ths in. thick, angle flange ½ in. wide, the two T flanges together 1 in., so as to leave about ¼ in. in projection on each side. He places them vertically and parallel to each other about 18 in. apart on the ships' side. He then introduces a length of, say 1½ in. wood sheathing, between or immediately behind the frames, using a portion of their rivets to fasten them on, the grooves in the ends of which correspond with the projections of the T-flange formed to receive them. He fastens one of the irons by tap-screws or rivets. He then lays on the ship's skin hair and tar, or any other suitable composition, puts one end of the wood in its place, then brings the other iron against the other end always with the flange outwards, and so on throughout. The ends of the separate pieces of sheathing meeting on the tops of the irons, the whole presents a surface as upon a wooden ship. He then caulks it and covers it with pitch and felt, so as to render it perfectly impervious to water. *Patent completed.*

666. H. WILSON. *Improvements in machinery for shaping wood.* Dated March 11, 1863.

This invention consists in constructing machinery (the details of which we cannot quote here) whereby wood is shaped, either one piece or several pieces at one time, to the form of a metal or other suitable hard template or guide by means of rotating cutters which act upon the wood in the direction of the grain thereof, whereby a smooth and even surface is obtained. *Patent completed.*

667. W. WOOD. *Improvements in the manufacture and ornamentation of pomfret or liquorice cakes, rolls, sticks, and pipes, and other similar articles of confectionery.* Dated March 11, 1863.

The object of the first part of these improvements is to make pomfret or liquorice cakes, rolls, sticks, and pipes coloured, and of various colours, instead of making them black. The patentee effects this by the following methods:—By repeatedly working, rolling, and drawing out the boiled liquorice paste or mixture when in a nearly cold and stiff state the colour becomes lighter, and this effect is increased by altering the usual ingredients of the mixture. If the flour ordinarily used be omitted, and an additional quantity of sugar used in lieu of it, the colour becomes very much lighter. By manipulating the paste as before described, boiled sugar, if repeatedly pulled when nearly cold and stiff, becomes quite white, and so, even when black extract of liquorice is used, alters with the above-named treatment the colour of the whole mass to a pale brownish colour. If a light-coloured extract of liquorice be used, the colour of the paste will be much lighter; it is also desirable to use white refined sugar and gum. When preparing this article, the patentee, by preference, uses the heated table and rollers described in the specification of his patent No. 356, of the year 1862, together with the subsequent reducing and drawing-out rollers and cake-making roller machinery that is described therein. *Patent completed.*

668. A. BARCLAY. *Improvements in locomotive, boring, and winding engines.* Dated March 11, 1863.

This invention relates to the arrangement and construction of boring and winding engines, which are also arranged to be self-propelling. Under one modification, the boiler of the engine forms the framing, or it may be carried on a rectangular framing, in the ordinary way. The boiler is of the horizontal tubular class, and on the upper part is arranged a pair of standards, which carry a horizontal shaft forming the axis of a beam; one end of this beam is connected to the piston rods of a pair of vertical cylinders placed on the upper part of the boiler at one end. The other end of the beam overhangs the end of the engine, and to this free extremity are attached the boring rods and tool. A horizontal cylinder is arranged parallel with the boiler on each side. The piston rods of these cylinders are connected to a crank shaft extending across the boiler. A pinion on the crank shaft drives a spur wheel on a shaft fitted between the beam standards, and carrying the winding barrel. This pinion slides to and fro on a feather, so that the winding barrel may be readily thrown into or out of gear by means of a coupling and hand lever. The crank shaft also carries a pinion or spur wheel at each end, which gears with an annular wheel formed inside each of the main or driving wheels of the engine, so that by putting these pinions into gear with the bearing wheels the engine becomes a traction engine. The engine is guided from the rear by means of a hand wheel arranged on a horizontal shaft extending beneath the boiler. This shaft carries at its extremity a worm, which gears with a worm-wheel connected by a central T-shaped connecting piece to the axles of the trailing wheels. The details of the engine may be variously arranged; the winding barrels may be fitted at either end of the engine, and, if preferred, arranged lower down. The funnel may also be fitted to serve as the standard for carrying the overhanging beams. Another mode of fitting this engine is to drive the crank shaft from a pair of right-angled cylinders arranged at the side of the framing. The boiler is preferred to be of the vertical class, and the funnel serving as the beam standard. A pinion on the crank shaft gives motion to the winding barrel, and on the same shaft are pinions for driving the bearing wheels. This engine is guided by a hand-wheel and worm arrangement for turning the leading wheels. *Patent completed.*

669. A. BARCLAY. *Improvements in traction engines and in apparatus for indicating the pressure of steam.* Dated March 11, 1863.

This invention relates, in the first place, to certain improvements in the construction and arrangement of traction engines, which improvements are based upon an invention of a similar kind for which letters patent were granted to the present patentee, dated March 10, 1862 (No. 646). Under one modification of the present invention, as applied to traction engines of the right-angled class, the crank shaft of each pair of engines has its bearings at one end arranged in the side standard or frame, whilst the other end is connected to the main axle, or to the centre of the driving wheel, so that this end of the shaft vibrates with the motion of the spring of the driving wheel, whilst the other end remains a fixture in its bearing. The other pair of engines have their crank shaft arranged in like manner, the fixed bearings being on opposite sides of the machine. In this way the vibrating motion of the wheels, as they traverse over the inequalities of the road, is imparted to one extremity of each crank shaft, but without affecting the opposite ends, which revolve steadily in their bearings. The object of the arrangement is to prevent the vibration of the driving wheels from affecting the heat of the valves. The driving wheels are arranged—one with a long tubular axle to which the wheel is keyed, and extending across the framing; the other wheel is fitted with an axle which passes through the tubular one, and is fastened by a nut. Or the two axles may be arranged parallel to rotate in contact, and thus obtain an extended bearing surface when the engines are driven at different speeds. The traction engine is coupled to the vehicle accompanying it by a T-shaped connecting piece, which is carried in a vertical spindle, its prolongation passing through two bushes carried by the framing of the connecting carriages, the hind wheels of which are connected with the engine by means of a shaft and wheels, or by connecting rods direct, so as to angle along with the engine when going round a curve. This arrangement admits of the lateral and vertical improvements of the coupled engine and vehicle. The traction engine may also be guided as well as regulated in speed by means of a duplex break action, which is operated by a single hand lever, so that the motion may be checked or the break applied to either side of the machine, and so guide it by the different speeds of the driving wheels. The improved pressure gauge consists of a metal or other chamber formed in two parts, and divided by an elastic air-proof diaphragm. Above the chamber is fitted a graduated glass tube, partly filled with water, which rests on the elastic diaphragm. The pressure of the steam raises the diaphragm and column of water, causing the air to be compressed, and in the ordinary gauges the air escapes through the water when subjected to long continued pressure, but by interposing the diaphragm of elastic air-proof material this escape is prevented, and the gauge continues correct in its indications. *Patent completed.*

670. J. WERGE. *Improvements in apparatus for indicating any regulated maximum or minimum degree of temperature.* (A communication.) Dated March 11, 1863.

This invention relates to a peculiar construction and arrangement of apparatus in connection with an alarm for indicating any regulated or given maximum or minimum degree of temperature, and consists in the employment of a compound metallic strip fixed at one end to a connecting piece in communication with one of the poles of a galvanic battery, whilst its opposite end is free to move to or fro by the action of heat or cold upon the two metals composing the compound strip, as is well understood. In combination with this strip, there is an adjustable indicator or pointer turning upon a fixed centre, and capable of being adjusted to any degree of heat or cold upon a properly divided thermometrical scale. This indicator is in communication with an electric alarm, and through it with the opposite pole of the battery. So long as the end of the compound metallic strip remains out of contact with the indicator, no alarm will be given, but as soon as an undue elevation of the temperature takes place, the strip will be deflected, and will come in contact with the indicator, whereupon the electric circuit being established, the alarm bell will commence to ring, and will continue so to ring until the original temperature is restored again. By the combination of the index, arm, scale, and metallic strip with a battery alarm apparatus and key-board, notice can be given of any variation of temperature beyond the regulated limits taking place at any number of points more or less distant, and an indication given of the particular point where such variation has taken place. In indicating an excess of cold, the strip will require to be placed on the opposite side of the indicator to that on which it is placed when intended for indicating an excess of heat. By employing a double index, the instrument may be employed for giving an alarm in case of either an increase or diminution of temperature above or below certain limits capable of regulation at pleasure. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated August 7, 1863.

1950. F. G. Mulholland, 36, Essex-street, Strand, engineer. Improvements in pipe castings for gas, water, sanitary, and other general purposes, and the introduction of an elastic chemical compound to form expansive joints thereto for prevention of leakage.

Dated August 26, 1863.

2103. J. Thomas, mechanic, and W. F. Marshall, reed maker, Shipley, Yorkshire. Improvements in apparatus for spinning.

Dated August 31, 1863.

2152. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improved machinery for sawing irregular forms of wood. (A communication.)

Dated September 17, 1863.

2285. J. G. Ulrich, 47, Wellclose-square, chronometer maker. Improvements in apparatus applied to railway carriages and trains in order to obtain greater safety to passengers.

Dated September 19, 1863.

2314. I. de Angelis, Naples, captain in the army. An improved apparatus for obtaining motive power. (A communication.)

Dated September 21, 1863.

2329. C. T. Burgess, 3, Upper Gower-street. Improvements in reaping machines.

Dated September 22, 1863.

2338. R. A. Brooman, 166, Fleet-street, patent agent. Certain compositions for preserving cheese. (A communication.)

Dated September 24, 1863.

2350. A. E. Ragon, Caroline-street, Bedford-square. Improved machinery or apparatus for stirring or mixing various ingredients or materials to a pasty consistence, the said machinery being especially adapted to the manufacture of bread and other articles of food. (A communication.)

2351. W. Woofe, Gloucester, agriculturist. Improvements in implements for tilling the soil, and in means of drawing ploughs and other implements for tilling through the land.

2352. T. Marshall, 12, Gate-street, Lincoln's-inn-fields, commercial clerk, and W. Marshall, 200, Regent-street, gentleman. Metallic instruments to be used as substitutes for bristles in sewing, stitching, closing, and otherwise joining boots, shoes, and other leather work.

2353. E. Dronke, Liverpool, merchant. An improved mode of manufacturing gunpowder suitable for war, mining, and general purposes. (A communication.)

2354. W. G. Helsby, Liverpool, photographic artist. Improvements in mounting or setting transparent photo graphic pictures.

2355. A. Firth, Bradford, Yorkshire, wheelwright and blacksmith. Improvements in furnaces for heating wheel hoops, applicable also for other similar purposes.

2356. J. Webster, Birmingham, engineer. Improvements in utilizing the waste flux from galvanizing works.

2357. J. Sturgeon, Leeds, consulting engineer. Improvements in machinery for cutting and boring coal and rocks.

2358. W. Oxley, Manchester, mill furnisher. Improvements in pickers for looms.

Dated September 25, 1863.

2363. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved joint for the tubes of surface condensers. (A communication.)

2364. P. Spence, Manchester, manufacturing chemist. Improvements in the production of sulpho-cyanide of ammonium and other sulpho-cyanides.

2365. E. Lloyd, Dee Valley, near Corwon, Merionethshire, engineer. Improvements in rotary engines to be worked by water, steam, air, and other motive power.

2366. M. Schaffhauser, Cernay, Upper Rhine, France, manufacturer. Improvements in the machinery for making paper tubes used in spinning manufactories.

Dated September 26, 1863.

2367. G. Spill, T. J. Briggs, and D. Spill, Hackney Wick. Improvements in the manufacture of driving straps or bands and of flexible tubes or hose.

2368. W. T. Rowlett, 90, Welford-road, Leicester, manufacturer. Improvements in crinolines and hooped skirts.

2369. R. Clarke, Altringham, Cheshire, skirt manufacturer. A new application of material for covering crinolines, and in the manufacture of the said material.

2370. W. Clark, 53, Chancery-lane, engineer. An improved fabric for the production of permanent electricity, applicable for wearing apparel. (A communication.)

2371. J. Spence, engineer, Portsmouth. An improved plastic composition, applicable to the coating of metallic and other surfaces.

2372. A. Gleerup, Copenhagen. An improved construction of gas-burner. (A communication.)

2374. W. Malan, Walpole-street, Deptford, civil engineer, and W. Tice, Downham-road, Islington, gas engineer. Improvements in apparatus for supplying gas to railway carriages and other moving structures, and in apparatus for manufacturing and holding gas in ships and other vessels, parts of such apparatus being also applicable for manufacturing and holding gas elsewhere.

Dated September 28, 1863.

2377. L. J. J. Jean, Paris, gentleman. Improvements in the construction of steam boilers, and in their firegrates.

2378. P. Bourchani, Paris, gentleman. An improved wax-light or candle stand.

2379. P. Cato, Liverpool, ship builder. Improvements in the construction of combined iron and timber ships.

2380. J. T. Harlow, Upper Saltley, near Birmingham, printer, and E. Harlow, Balsall Heath, Worcester, gun maker. Improvements in breech-loading firearms.

2381. W. E. Gedge, 11, Wellington-street, Strand. Improved apparatus for heating by means of illuminating gas. (A communication.)

2382. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the manufacture of boot and shoe toe pieces or tips, and in the machinery or apparatus. (A communication.)

2384. G. Thomas, 50, Chichester-villas, Kilburn-park, builder. Improvements in Louvre shutters and Venetian blinds.

Dated September 29, 1863.

2385. F. Preston, Manchester, engineer. Improvements in machinery for rolling and cutting files and rasps.

2386. F. G. Mulholland, 36, Essex-street, Strand, civil engineer. Improvements in the mode of manufacturing submarine telegraph cables, in apparatus connected therewith, and in the method or principle of laying the same, and in the preparation of the several compounds described for electric insulation and other purposes.

2387. S. Mendel, Manchester, merchant. Improvements in the manufacture of woven fabrics, applicable to covering telegraph wires.

2388. H. Haigh and R. Heaton, Milns Bridge, near Huddersfield, dyers. Improvements in dyeing cotton or other vegetable fibrous substances.

2389. W. Clark, 53, Chancery-lane, engineer. An improvement in the soles of boots and shoes. (A communication.)

2390. W. E. Gedge, 11, Wellington-street, Strand. Improvements in parts of the permanent way of railways. (A communication.)

2391. J. Cooper, Ipswich, agricultural implement maker. Improvements in the construction of harrows.

2392. P. and J. Llewellin and J. W. James, Bristol, brassfounders. Improvements in water closets.

Dated September 30, 1863.

2393. J. J. Chidley, gentleman, 11, Glaskin-street, Hackney. An improved bottle and stopper.

2394. W. Clark, 53, Chancery-lane, engineer. Improvements in musical instruments. (A communication.)

2398. G. Elliot, Betley Hall, Staffordshire, colliery owner. Improvements in props and supports for coal and other mines.

2399. B. Browne, 49, King William-street, London Bridge, civil engineer. An improved sight-piece for rifles. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated September 30, 1863.

2397. E. W. Bullard, Massachusetts, United States. A new and useful machine or carriage for turning and spreading hay, and for other useful agricultural purposes.

Dated October 1, 1863.

2401. J. Mackay, Aigburth, Lancashire. Certain improvements in firearms, ordnance, and projectiles.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, October 13, 1863.

1343. F. Osbourn. Pressing, smoothing, and finishing garments.

1348. E. Ironmonger. Improved loose clip and socket joint.

1354. W. Green. Producing black colouring matters or pigments.

1364. J. Chalmers. Armour for forts and floating batteries.

1370. C. Belcher. Cutting and transplanting turf.

1371. H. C. Coulthard. Packing for the glands of piston rods.

1373. A. Illingworth. Boots and shoes or similar coverings for the feet.

1393. S. Blake, T. Lee, and R. Dutton. Flour and meal mills.

1394. H. Rigby. Steam boilers and furnaces.

1396. H. Pollack. Manufacture of scarlet, brown, and orange colours.

1399. F. A. Calvert. Steam engines, steam boilers, and steam heating apparatus.

1401. A. Q. de Gromard. Musical instruments.

1404. J. Seaman. Cultivation of the soil.

1406. J. H. Johnson. Smoothing irons. (A com.)

1407. W. A. Brown. Railway trains.

1410. C. E. Newcomen. Treatment of peat and other substances containing moisture.

1419. W. E. Gedge. Construction of kites. (A communication.)

1429. B. Dobson and D. Greenhalgh. Preparing fibrous substances.

1443. T. Adams. Slide and other valves.

1449. W. Clark. Obtaining and applying motive power. (A communication.)

1451. M. Henry. Treating floss silk and silk waste. (A communication.)

1455. C. L. Van Tenac. Daily balance book. (A communication.)

1457. W. Walton. Pneumatic hammer.

1460. E. O. Hallett. Constructing the sides of ships, batteries, and fortifications, and applying armour plates thereto.

1465. F. A. and F. Calvert. Burring, ginning, cleaning, and carding fibrous substances.

1476. G. Davidson. Manufacture of paper bags.

1479. T. Wrigley. Filtering or cleansing water or other fluids.

1523. W. Naylor. Compressing, holding, and regulating the pressure of gas.

1539. J. Watts. Manufacture of malt.

1541. W. E. Newton. Manufacture of leaden pipes. (A communication.)

1569. W. Clark. Charging air or gases with combustible vapours. (A communication.)

1601. J. O. Mathieu. Twisting machines.

1672. A. and B. S. Gower. Sowing and harrowing machine.

1692. G. Haseltine. Brick machines. (A com.)

1830. W. Naylor. Safety valves.

1832. P. R. Jackson. Rolling hoops and tyres.

2152. A. V. Newton. Sawing irregular forms of wood. (A communication.)

2162. G. T. Bousfield. Manufacture of illuminating gas. (A communication.)

2205. J. C. Lott. Turning over the leaves of music.

2213. W. H. Tucker. Propelling and steering vessels.

2228. E. Oliver. Lowering and disengaging boats from vessels.

2233. M. A. Muir and J. McIlwham. Winding yarns or thread.

2237. W. Taylor. Manufacture of iron rods.

2314. I. de Angelis. Obtaining motive power. (A com.)

2317. T. E. Vickers. Manufacture of cast steel tyres. (A communication.)

2331. T. B. Daft. Construction of iron ships.

2336. C. Maitland. Mashing apparatus.

2394. W. Clark. Musical instruments. (A com.)

2397. E. W. Bullard. Turning and spreading hay.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed October 9, 1863.

917. D. Mylrea.
920. W. Clark.
921. P. P. Baly.
922. A. F. Maclure.
931. M. Myers.
932. T. Mallinson and P. Williams.
935. G. T. Smith.
940. R. A. Brooman.
941. R. A. Brooman.
943. J. Leach.
945. T. Gray.
946. W. Clark.
949. W. Spence.
950. H. Eaton.
956. I. Baggs and W. Simpson.
959. W. Oldfield.
960. A. Samuelson.
963. R. Knight.
966. J. Goucher.
967. R. C. Clapham.
972. C. W. Siemens and F. Siemens.
976. G. A. Buchholz.
981. C. Blanc.
984. E. W. Hughes.
993. H. Donald.
998. F. E. Bryant.
1000. F. Durand.
1009. R. Richardson.
1027. J. H. Johnson.
1029. L. de Breanski.
1074. S. S. Marling.
1081. H. Worms.
1094. J. H. Johnson.
1095. J. M'F. Gray.
1115. J. H. Johnson.
1156. W. Clark.
1185. J. Shanks.
1242. H. Bennett.
1247. J. Beaumont.
1360. V. Baker.
1445. W. Wells and J. W. Myers.
1778. H. Mège.
2020. P. F. L. B. Him.
2069. J. Fleming.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2429. D. Cope.
2442. E. Gardner.
2445. J. Edge.
2457. G. Bonelli.
2460. J. Ramsbottom.
2462. C. Wheatstone.
2468. R. Hornsby.
2471. T. Whitby and W. Dempsey.
2478. W. Barker.
2499. J. J. Russell and B. L. Brown.
2501. J. Higgins and T. S. Whitworth.
2534. R. G. McCrum.
2348. W. Andrews.
2574. J. and J. Wadsworth.
2792. J. S. Crosland.
2989. H. Jordan.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2352. F. Whitehead.
2358. D. Joy and W. Holt.
2405. T. Allen.

*** No printed specifications were published last Saturday.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

IRON:—

		£	s.	d.		£	s.	d.	per
Welsh Bars, in London	per ton	7	10	0	to	0	0	0	2½
Nail Rods	do	8	0	0		8	10	0	
Hoops	do	10	10	0		0	0	0	
Sheets, single	do	11	0	0		0	0	0	
Staffordshire Bars	do	9	10	0		0	0	0	
Bars, in Wales	do	6	10	0		6	15	0	
Rails	do	6	15	0		0	0	0	nett
Foundry Pigs, at Glasg, No 1	do	3	0	0		3	7	0	
Swedish Bars	do	11	10	0		12	10	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		15	10	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	102	0	0		0	0	0	3
Hammered Bottoms	do	112	0	0		0	0	0	
Flat Bottoms, not Hamrd.	do	107	0	0		0	0	0	
Tough Cake and Ingot	do	95	0	0		0	0	0	
Tile Copper	do	93	0	0		0	0	0	
Best Selected	do	98	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8¼		0	0	8½	
Fine Foreign	per ton	98	0	0		100	0	0	
TIN:—									
English Block	per cwt.	5	15	0		0	0	0	2½
do Bar	do	5	16	0		0	0	0	
do Refined	do	6	0	0		0	0	0	
Banca	do	6	2	0		6	3	0	nett
Straits	do	5	18	0		5	17	0	

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.		£	s.	£	s.
Teak load	12	0	13	0	Archangel, yellow	13	0	13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
,, yellow pine	3	10	4	10	Finland	9	0	11	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	1[illegible]	0
Quebec oak, white	5	10	6	10	Gothenburg yellow	10	0	11	0
,, birch	3	10	4	10	,, white	9	0	[illegible]	10
,, elm	3	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderham	9	10	10	[illegible]
,, fir	2	10	3	10	Christiania, per C., 12ft. by 3 by 9 in.				
Memel fir	3	5	3	10					
Riga	3	0	3	5	Christiania, yellow	21	0	23	0
Swedish	2	10	2	15	Deck Plank, Dantzic, per 40 ft. 3 in.	0	18	1	1
Masts, Quebec red pine	5	0	6	0					
,, yellow pine	5	0	6	0	PUMICE STONE pr ton	8	10	9	0
Lathwood, Dantzic, fm	5	10	6	10	OILS, &c.				
,, St. Petersburg	8	0	8	10	Seal, pale ...per tun	45	0	45	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	78	0	80	0
					Cod	56	0	0	0
					Whale, Sth Sea, pale	43	10	44	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	59	0	60	0
St. John, white spruce	14	0	15	10	Cocoanut, Cochin	47	10	48	0
Yellow pine, per reduced C.					Palm, fine	35	10	30	[illegible]
					Linseed	42	10	42	[illegible]
Canada, 1st qual.	17	0	18	0	Rapeseed Eng. pale	43	10	44	0
,, 2nd do.	11	0	12	0	Cottonseed	31	0	32	0

FRENCH & SMITH, Sworn Brokers, 4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number.—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 23, 1863.

ORDNANCE.

THE expenditure of two millions seven hundred thousand pounds sterling on gunnery experiments, has failed to supply the nation with a gun capable of superseding the now old-fashioned 68-pounder. The forces developed by exploding gunpowder are at once so tremendous, and so anomalous in their effects, that they have hitherto set the skill of the engineer at defiance, the manufacturing arts of the present day proving quite unable to cope with them effectually. The difficulties encountered in the manipulation of large masses of wrought iron at a high heat, are of the gravest character, and generally result in such a deterioration of its structure, that the heaviest guns, forged either solid or in coils, seldom prove good for much. If we resort to cast iron, we find it anything but easy to procure castings of large size, thoroughly homogeneous throughout their structure; and even though such a result could be arrived at with ease and certainty, it is more than doubtful if it would secure the most proper distribution of the strength of the material. These, which may be termed, to some extent, constructive difficulties, are not the most serious we have to encounter. The fact is, that we do not yet thoroughly understand the nature, direction, or amount of the strains to which guns are exposed. We only know certainly, that these are sufficient to tax the metal of which ordnance is made, to an extent vastly greater than that to which like materials are ever exposed in other situations. The most prominent result of this comparative ignorance is, that we are unable to burn quantities of powder proportionate to the size of abnormal cannon, and heavy shot is in consequence inefficient, from its low initial velocity. The success of iron-plated ships, in warfare, depends materially on this fact.

In order to understand what the effects of exploding gunpowder are on a gun, it is necessary to be able to comprehend the division of time into very minute spaces. Fortunately, we have so many practical instances of this subdivision, that illustrations are easily found. Thus, a projectile moving at 2,000 ft. per second, divides that space of time into 2,000 comprehensible parts, and we can conceive of each of these, minute as they are, being yet again divided into 12ths, by the progress of the shot through each separate inch of its flight. Time is merely a relative term; and in many of the operations of nature, a second really represents an enormous measure of duration. The explosion of gunpowder, instantaneous as it may appear to the superficial observer, is not so to the man of science. An explosive compound, known as "white gunpowder," vanishes on the application of a match with a rapidity, compared to which the combustion of gunpowder is extremely tardy; while fulminate of silver explodes with still greater speed. It is pretty well understood that strains are not transmitted through the mass of a gun with anything like the velocity necessary to enable the iron of which it is composed to exert the full powers of resistance due to its sectional area; and, in consequence, the inner surface of the chase is taxed to the uttermost, while the outer rings of the gun experience hardly any strain. It is more than doubtful if any gun of ordinary construction, free from flaws or imperfections, has ever burst on the first discharge, even with proof loads. Yet we know that the duration of guns firing heavy charges is extremely limited. The powers of resistance of the inner portions of the metal are gradually destroyed, and the good qualities of the iron, be it cast or wrought, are broken down and annihilated in detail, from the inner to the outer surfaces. Hence it is that a mere increase in the weight of guns does little good. A repetition of the process of loading and firing is certain to ultimately destroy any gun, provided the force developed by the charges is sufficient to overcome the limits of elasticity of the first fraction of an inch of the metal next the chase. With the largest American ordnance, slow-burning powder can alone be employed in large charges; not because the total bursting strain is less, for the contrary is the fact; but because its action is extended over a longer space of time, and the strain is, in consequence, transmitted in a pulsation or wave, so to speak, through every portion of the metal. Gun-cotton explodes so rapidly, that it breaks down and disintegrates the surfaces with which it is in contact, as though they were formed of glass instead of iron; and its use for artillery purposes has been as yet confined to a few very exceptional cases.

The initial strain, however, of the exploding charge, confined for a fraction of the thousandth part of a second to the surfaces of the chase, and a small thickness of the gun in their immediate neighbourhood, is quickly succeeded by another through the entire substance of the gun, tending to burst it by pressure without impact. Wrought-iron hoops shrunk on a cast-iron gun are of the greatest possible service in this stage of the explosion, by resisting successfully what we may term the secondary strain, which, however, nearly identical as it must be with the first, may not reach the hoops until the shot has been sensibly moved. Artillerists have been aware of these facts for some time, and it certainly appears strange to us that no attempt has ever been made in this country to defend the gun from the first strain of the exploding powder, which is, we believe, the real element of destruction, owing to its localization. Notwithstanding our knowledge of the peculiar and apparently paradoxical effects produced by the combustion of explosive compounds of every kind, scarcely any alteration has ever been made in the methods of loading a gun since the days of "Mons Meg." Cartridges of an invariable pattern are nearly always employed; the powder, placed in a more or less compact mass, fills the chamber or rear end of the chase, in contact alike with the projectile and the walls of the gun. The expediency of a different arrangement, in this country has never been called in question; yet some recent American experiments have given such remarkable results, as would seem to denote that our success in this matter of great guns may yet depend more or less on the arrangement of the charge. We have already alluded to this experiment; still, we deem it advisable to place the details once more before our readers. A 7-in. gun was loaded with a full charge of powder, made up in a cartridge only 6 in. in external diameter, and supported within the bore of the cannon in such a manner, that a clear space of half an inch remained between the circumference of the cartridge and the chase all round; the shot was in immediate contact with the powder. The result of this arrangement was, that while the shot retained its full initial velocity on the discharge of the weapon, the strain on the gun was reduced nearly one-half. The terms of this experiment have been stated to us on authority which we have no reason to consider doubtful. The explanation of the phenomena is not, however, very easy; yet this is not the only one connected with gunpowder which is apparently paradoxical. General Piobert relates an experiment made in 1826 by General Pelletier, in which several pounds of powder were spread on a wooden table laid on soft earth. The combustion of the powder caused only a slight depression of the table; but when the experiment was changed by placing a sheet of paper over the powder, the table was shattered to atoms; and many experiments equally strange in their results will at once present themselves to those who have studied the subject even superficially.

The results obtained by Lynall Thomas, in the course of his investigations, seem to afford conclusive evidence, that the first and by far the most powerful action of fired gunpowder is percussive; the effects produced on resisting surfaces resembling, more or less, those of a blow. The second effect is that of pressure, due to the gases set free by the explosion and expanded by its heat. What the precise cause of this percussive action is, no one, we believe, has as yet pretended to determine. Once the mere fact of its existence is admitted, we are placed in a position to understand in some degree, the *rationale* of the American experiment. The stratum of air between the cartridge and the surface of the chase evidently acted the part of a cushion, absorbing a great portion of the initial strain in its violent compression; the wave of transmitted force being unable to pass through it with sufficient velocity, to affect the gun materially, until the initial effort of the powder had ceased. To the secondary strain the gun was fully exposed, as shown by the pressure plug. The projectile being submitted to the percussive action of the powder and the impulsive force of the gases, of course, pursued its flight as usual. The action is probably much the same in a fowling-piece the muzzle of which becomes stopped with a little snow or earth. Its discharge, under such circumcunstances, generally causes it to burst, especially if the gun is a long one; most probably because the compression of the air extends with such slowness, as compared with the rapidity of the combustion of the powder, that, while one end of the column within the barrel is compressed sufficiently to burst it, the other end is not condensed enough to remove the obstruction. The gun barrel frequently swells under such circumstances, the obstacle being expelled before a bursting pressure is arrived at. Robins found that, by placing the bullet within a musket at the distance of 11 1-5th inches from the charge, its velocity was increased by 200 feet per second; and it has therefore been argued that the passage of a wave of compression through the column of air in the gun, has nothing to say to its explosion when an obstacle is placed in the muzzle. Yet it must be remembered that the recoil of the gun is always materially increased under such circumstances, as well as the entire force developed; while the effect on the projectile must be secondary, and in no way due to the percussive action of the powder—the force, of all others, most injurious to a large gun.

We do not wish to be understood as making any positive assertions on this subject. We prefer suggestion to dogmatism; and we feel certain that the question of the practicability of defending a gun from the initial action of the exploding charge, is one fraught with the deepest interest. A series of experiments carefully conducted with this end in view, are absolutely essential to the increase in our

knowledge of the action of gunpowder, rendered more needful than ever by our continued failures in the attempt to produce a really good as well as great gun. Rapid as the explosion of gunpowder is, there yet remains no room to doubt that the operation is really divided into several stages, each of which is attended with a different effect on both gun and projectile. Did the strength of a gun depend on its power of resisting a steadily exerted pressure, there would be little or no difficulty in making it strong enough to resist a strain of perhaps 30 tons on the the square inch. It is not in the mere pressure of the gases produced by an explosion, that the difficulty resides, but in its, to some extent, mysterious initial force. Whether this force can be absorbed by an air-spring, or otherwise, remains to be proved. It is highly probable that it can. We have no positive evidence to the contrary; and until we have, we will continue to believe in the practicability of the expedient. It may yet be deemed advisable to construct guns with a considerable enlargement at the breech, into which the powder cartridge, probably affixed to the rear end of the shot, would project; a clear space of an inch or so being left all round between it and the metal. Coiled guns have always proved deficient in longitudinal strength. An air-cushion between the powder and the breech, might possibly aid in overcoming this objection. Many of the mightiest forces in nature have been made available for the service of man by careful management. We have encountered the power of gunpowder by sheer brute force for a long time without success; and it is time that we endeavoured to elude that which we cannot conquer.

V. P.

NOMINAL HORSE POWER.

OF all the absurd terms to be met with in the vocabulary of mechanical arts, that of "nominal horse power" is perhaps the most absurd. Particular measures and weights bear, very properly, individual appellations, which, if not invariable in their meaning in a general sense, are so in particular instances. Thus, the term "pound," individually, does not it is true, invariably denote one certain measure of the force of gravitation; different merchants employing it in various senses, according to the kind of trade they carry on. The pound of the jeweller is one thing; that of the corn merchant another. Yet the troy weight of the one can never be confounded with the avoirdupois weight of the other. The phrases "troy weight" and "apothecaries' weight" are understood throughout the length and breadth of the kingdom, and are rarely, if ever, confounded with each other. Measures of length are still more definite. A foot is equally a foot with the carpenter and the engineer, the worker in stone and the worker in iron, all over the kingdom. A two-foot rule which can be used in London is equally serviceable in Manchester and Liverpool, Hull or Glasgow. Our engines are bought and sold at the rate of so much per nominal horse power; and it is certainly strange, considering the enormous sums which annually change hands in the trade, that there should be no fixed and definite meaning attached to the expression. Not only does it convey no idea whatever of the power of any steam engine, but it fails equally in expressing size. Were this all, its use might be pardonable; but, on examination, we find that nearly every centre of manufacturing industry attaches a special value to it, different from that which obtains elsewhere; a nominal horse power meaning one thing at Leeds, another thing at Glasgow, and something else at London; even different makers employing the phrase in distinctive senses, according to their individual proclivities.

It is easy enough to trace the origin of the term. Our coal-pits were, less than a century and a half ago, almost wholly dependent on horse power for their successful working. Yoked to the "gin," four or five horses performed their daily and nightly rounds, clearing the comparatively shallow pits, alike of their produce, and the water which would otherwise have inundated the workings. Hundreds of small mines are worked to this day by similar means, in South Staffordshire and many other mining districts. Savary's engine, introduced about the year 1700, met with but partial favour; and horses retained their place, even after the invention, or rather employment, of Newcomen's engine some fifteen years later. No record exists of the use of the words "horse power" as applied to the steam engine up to or at that time. When James Watt, however, entered on the scene, in 1775, or thereabouts, his engines were found so efficient that they quickly displaced horse labour. Still colliery proprietors and ironmasters, when applying at Soho for engines to drain their pits, were in the habit of measuring the amount of power they required by mentioning the number of horses which the engine was intended to replace. Boulton and Watt, quickly finding this comparative measure of engine power extremely useful, extended it to their advertising sheets, and it thus became all but universal throughout the country. During the first few years of his career as an engine builder, Watt adhered almost exclusively to one particular speed of piston per minute, only departing from it in exceptional cases, when engines were constructed out of the usual routine of the shops. He was not long in business, however, until he discovered that the term "horse power" conveyed too vague an idea to answer the purposes of a vastly extended trade. He accordingly instituted some experiments at one of the London breweries with the largest and strongest horses which he could obtain. A finely-turned brass pulley was affixed to the edge of a well; over this pulley a carefully made rope was run, one end descending the well, where it was attached to weights, altered as occasion required, while the other end was drawn forward by a horse, which thus raised the weight. From the results obtained from this, and some other experiments, Watt determined the power of a strong horse to be equal to a weight of 33,000lbs., raised one foot in one minute; the horse being capable of maintaining this exertion for eight hours per day. This was the highest average obtained from the most powerful horses. Watt's first boilers were worked at an extremely low pressure, not more than 2 lbs. or 3 lbs. on the square inch above the atmosphere His machinery was not very perfect; and the pressure on the pistons of his earlier engines seldom exceeded 10 lbs. or 12 lbs. on the square inch. Newcomen's engines had an available pressure of not more than 7 lbs. or 8 lbs. on the inch. Those who bought from the Soho firm, could scarcely be induced to believe in the possibility of obtaining anything much over this; and as there was a doubt amongst the public, Watt gave them the benefit of it; and determining that his customers should receive even more than they bargained for, he magnanimously adopted the highest possible standard of horse power, and the lowest of steam pressure; and thus the Soho nominal horse power was measured by a piston moving at a speed of 128 ft. per minute, under a pressure of but 7 lbs. to the square inch. Other firms, however, quickly started into existence, who found it expedient to depart both from Watt's standards of speed and pressure, and in consequence different estimates of nominal horse power were adopted in different districts, and continue in force at the present moment. The standards adopted are, in many instances, simply ridiculous. Thus, at Leeds, a nominal horse power means 30 circular inches of piston area, without regard to either speed or pressure; while at Manchester 23 square inches are regarded as the proportion. The weight of a fly-wheel, or the thickness of a cylinder, might be selected as measures of the actual work performed with equal propriety. In Glasgow and London, pressure is employed as the standard; the mercantile value of a steam engine being calculated by an assumed pressure of 7½ lbs. to the square inch at the former place, and 7 lbs. at the latter, the regulation piston speeds being settled by empirical rules which bear little or no relation to practical results. Those adopted by the Admiralty may be selected as an example. The speed is supposed to vary with the stroke. With a 4 ft. stroke the piston speed calculated on is 196 ft.; with 5 ft. stroke, 210 ft.; with a 6 ft. stroke, 228 ft.; with a 7 ft. stroke, 231 ft.; with an 8 ft. stroke, 240 ft. per minute; and so on. It is almost needless to say that these velocities are seldom or never really adhered to. The average pressure maintained in the boilers of our Navy may be taken somewhere about 18 lbs. to the square inch. If to this we add 12 lbs. for vacuum, and deduct 4 lbs. for wire-drawing and loss, the actual working pressure per square inch of piston becomes nearly three times the nominal pressure. It is thus that the indicated power of marine and other engines exceeds the nominal many times. How many depending, in a great degree, on the good faith of the firm contracting for the machinery and not at all on the stipulations of the contract! There are various instances in our Navy and mercantile marine where similar ships attain very different velocities with engines of the same nominal horse power, made by different firms; the speed depending not on the nominal but on the indicated power. Setting the general public aside, we thus find that the Government, by purchasing engines at the rate of so much per nominal horse power, place themselves completely in the hands of the manufacturers. The naval architect may calculate that 2,000 effective horse power is sufficient to drive a particular ship at a certain speed. Engines of 400-horse power nominal are ordered, in the expectation that they will work up to the required power. Whether they do or not rests with the makers. If they develop a force of 1,200 horses only, the designer of the ship is disappointed, but no blame can attach to the makers of the machinery. There are engines at this moment in the Navy giving out eight times their nominal power; many others only three; the first cost of the machinery being as nearly as possible the same in both cases. It is not strange, when we consider these things, that so many of our ships have failed to realize the speeds predicted for them.

A simple remedy exists for this state of affairs. Let the purchaser stipulate how many indicated horse power he requires, and pay for his engines by that standard. Such a course would be found, in the long run, beneficial to all parties. Many firms are at present excluded from Admiralty work because their reputation is not established; and the Government, having no check over them under existing arrangements of purchase and sale, fear to

employ them, lest the indicated should not sufficiently exceed the nominal horse power. The sooner steam engines are bought and sold by real instead of ideal standards, the better. The words "horse power" are seldom or never used in connection with the locomotive; yet purchasers always get exactly what they want. Imaginary and arbitrary measures of either size, capacity, or power, are certain to lead the unwary and inexperienced astray, and are unsuitable to the advancement of the age.

THE PHILOSOPHY OF RIFLING ORDNANCE.

The most perfect system of artillery will be that in which, all other conditions being equal, rotation of an elongated projectile is obtained by spiral rifling with the least tension on the gun.

The simple and obvious mode of imparting rotary motion to a cylindrical shot seems not to have found favour with artillerists. And yet a lesson might be drawn from such familiar examples as a boy's top, a teetotum, or a wheel on its axis. They are set spinning by the application of the motive force, without obstruction or hindrance, to the revolving body. To impart velocity to a carriage, the wheels are allowed to turn freely. To retard its too rapid progress, the break is applied.

Instead of following the simple rule referred to, inventors of rifle systems have recourse, more or less, to the forcing or friction principle. They place the projectile under conditions, which compel it to force its way into or along spiral grooves or ribs, or to burst the gun. One method is the compression system of Armstrong, copied from the Wahrenhoff, which moulds the lead coating of the shot into the grooves of the gun. Another plan is the expansion system, by which a soft metal disc or plug, at the rear of the projectile, is driven by the explosion into and through the rifling of the gun. Of this the Bashley Brittens and Parrots are examples. The friction systems are represented by Lancaster's oval, Whitworth's hexagonal, the French or Commander Scott's iron-winged, and Lynall Thomas's ribbed rifling, the projectiles all rotating by pressure on opposite sides of the bore.

These plans, without exception, are on the forcing principle, absorb by friction a large portion of the propelling power, and in various degrees cause strain on the gun. This strain, retarding the shot in passing along the bore and tending to destroy the gun, is the evil of the rifle systems hitherto employed.

To counteract this evil, singularly enough, all the plans devised have been in the direction, not of avoiding forcing, but of strengthening the gun to enable it to resist the strain—a course which involves increased weight and cost of the piece. But no weight of metal or expense has been sufficient to produce a gun, of large calibre, capable of standing the tremendous tension resulting from forced rifling. Under its ordeal Armstrong, Whitworth, Lynall Thomas, Lancaster, Scott, and other rifled guns have burst when put to a continuous proof test. The experience with American ordnance of a similar character has been the same.

The energy of the explosive force of gunpowder, confined and compressed in a chamber of enormous strength, can hardly be calculated. The blasting of rocks, the explosion of shells, the bursting of great guns, give some idea of its irresistible power. Its effects are those of boiler explosions, when, the safety valve ceasing to act, high-pressure steam bursts its bounds. The action of forced rifling is of a similar nature. The shot which, if it offered no resistance but its weight, would yield to the explosion and be a safety valve for the escape of the elastic fluid, being jammed into the bore, is checked and cannot force its way out of the gun with sufficient velocity. The energy of the compressed gas, not having time for expansion, becomes too intense, the metal yields and bursts asunder, with destructive effects, of which examples are exhibited in the mutilated remains of rifled guns, lying in long rows at Woolwich Arsenal.

So long as the forcing system is maintained, no real progress will be made in rifling cannon. On this subject interesting and valuable data are supplied by the report of the Ordnance Select Committee, ordered to be printed by the House of Commons on the 23rd July last. I extract from it the subjoined table of experiments on different rifle systems, giving the breaking weight in tons for each kind of rifling:—

Table of Experiments on Cast-iron Rifle Sockets.

Extracted from the Report of the Ordnance Select Committee.

No. of Diagram.	Name.	Nature of Rifling.	Breaking weight in tons at circumference
1	Lancaster	Oval	7·02
2	Experimental	Decagon	23·29
3	Sir W. Armstrong	3-grooved shunt	25·65
4	Com. Scott.........	3 grooves in socket, but only 2 ribs bearing...	27·93
5	Whitworth.........	Hexagon	28·07
6	Com. Scott.........	2 grooves opposite to each other	29·0
7	Experimental	2 grooves opposite to each other	29·18
8	L. Thomas	3 ribs	35·09
9	Com. Scott.........	3 grooves..........	35·30
10	Sir W. Armstrong	10-grooved shunt	46·50*

These experiments were carried out by Mr. Anderson, the superintendent of the gun factory at Woolwich. Iron plugs, representing the shot, were forced by torsion into cast-iron sockets, representing the systems of rifling. So far as they go, they afford comparative data; but no positive conclusions can be drawn from them; and great doubt of their accuracy is raised, when it appears that Lancaster's oval bore yields to a breaking weight of 7 tons, whilst the resistance of all the other systems is from 23 to 46 tons, or three to five times greater. From what is known of the oval bore, from the results of continuous firing in competition with other guns, with proof charges, it is apparent that no such discrepancy exists in practice. It is very doubtful, whether mechanical strain, by torsion, is any criterion of the effects of the elastic pressure of exploding gas. The chief merit of these experiments is the evidence they afford of the vast importance of the question, in the opinion of the most practical officer in the ordnance department. It has, no doubt, been seriously considered by the Select Committee; but there is no indication in their report, that they are impressed with the absolute necessity of adopting a mode of rifling which is not on the forcing system.

Mr. Anderson evidently has misgivings in his mind, as to the value of the existing systems. In his evidence he says, "that for some time past, a question has been frequently raised in regard to the tendency, which different descriptions of rifling have to split the gun. The power required to give the rotary motion to the projectile, through the agency of ribs or grooves in the gun, must necessarily cause *an opposite straining in the gun, tending to open it, or else to break the metal without entirely splitting*. We can easily perceive that an inclined surface is more apt to split the structure, than a flat or perpendicular surface; but there were no precise data in regard to the position in which different planes stand with regard to each other."

* At this weight the plug broke, and the cylinder showed a slight crack.

These words convey a plain avowal that all the known plans of rifling tend to *open the gun and split the metal* by the opposite straining of the projectile against the grooves or ribs of the gun.

This is the very evil above pointed out; and to overcome it, instead of employing, as the medium of rifling, a bursting force, which any strength of metal, however great, in the form of a gun, seems powerless to resist, it would be wiser to remove its cause, by producing rotation on the natural principle of causing the projectile to rotate in the bore without obstructing it at all.

As bearing on the question, on the principle of *lucus à non lucendo*, the Ordnance Select Committee have published in their report a table of instructions on the "Mode of Testing the Value of a Gun," in which *they omit any mention of rifling*. Verily, the Ordnance Department does not keep pace with modern improvements in artillery!

Mode of Testing the Value of a Gun for a truly-proportioned Gun.

Extracted from the Report of the Ordnance Select Committee.

	Marks.
Lowest angle of elevation	150
Accuracy at long ranges..	100
Rapidity of loading..	150
Freedom from fouling...	150
Durability and simplicity of arrangement of a breech-loader...	100
Projectile—its cheapness and freedom from liability to injury in service or in store...........................	100
Initial velocity..	150
Destructive power against iron plates at long ranges	100
	1,000

The valuable properties of a gun are here represented by proportionate numbers in one thousand marks; but no place whatever is given to rifling, although it is admitted to be the most important element of the stancture. It may, with reason, be suggested that "simplicity and minimum strain of rifling" should stand at 250 marks at least in the 1,000 marks which are fixed as the standard of a "truly proportioned gun."

If to this condition were added one to the effect that the system of rifling should be of such a nature, as to admit of the weapon being used as a rifle or a smooth-bore, there can be no doubt that a naval and siege gun might be produced of the highest value for both services.

Civilian.

BOILER EXPLOSIONS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Mr. Colburn having, last week, disavowed the chronological inversion of events referred to in my last letter, and acknowledged that our discussion upon the explosion on board the "Great Eastern" took place in the earlier half of the week following the explosion, *before* he published his article on the subject in the *Engineer*, that settles the only point raised in his first letter in your paper of the 2nd instant.

He now prints a note from his friend Mr Holley, in which all that this gentlemen ascribes to him is the suggestion of "the sudden generation of steam upon the reduction of pressure by rupture." But I, too, and hundreds more, have made the same suggestion. In 1854, I conducted a series of experiments on the quantity of steam generated under reduced pressure in steam boilers, the results of which were given in evidence before a Parliamentary Committee in that year. But Mr. Holley says it was suggested as "the groundwork of the percussive theory of

explosions." If this be granted, I have it in evidence from Mr. Colburn that, whilst *he* suggested the sudden generation, *I* suggested the form of action—by percussion; for, he writes to me on the 23rd November, 1859, "*I believe I was the one to suggest the disengagement of the steam from hot water; you confirmed my belief in several ways, and you have given me nearly all I knew of the action of steam by momentum.* My views on decomposition, electricity, &c., are borrowed, and I lay no claim to originality in them." This was written with reference to a wish on his part that I should write an introduction to the proposed joint pamphlet, "stating the share of each."

Again, that he had not, at the time, any conception of percussive action in the explosion on board the "Great Eastern" is clear from his account of it in the *Engineer* of the 16th September, 1859. "The casing," he says, "must have been full of water, which was, *to a great extent* [on the 23rd he suggests *all* the water], instantaneously converted into steam, and with an energy sufficient to complete the catastrophe by exploding the outer casing." That this was not the mode of action, is evident enough when one considers that not more than 1-160th part of the water could have been converted into steam before the explosion, seeing, as he admits, that the first incident of failure was collapse. Not a word about the escape of steam from over the water, nor from the heated water, nor the faintest suggestion or allowance to percussive action at all. But, Sir, this suggestion of the entire conversion of the water into steam, erroneous as it is, was merely borrowed from Harshman, whose views had appeared in his tract of 1855, and parly in the *Engineer*, in the month of August, 1859; and when I refer to Harshman as a precedent for Mr. Colburn, I do not allude to the points of difference between them, to which Mr. Colburn assiduously calls your attention, but to the points of identity.

Moreover, Mr. Holley's version of the explosion, in his account of the trip, in the same number of the *Engineer*, of the 16th September, 1859, is like that of Mr. Colburn, with a difference. He says:—"*All* the water in the heater, some tons, being at the heat of steam at, say, 50 lbs., when the pressure of 50 lbs. was removed, would flash off into steam *of a lower pressure*, but of immense volume, which in its effect is equivalent to a *terrifically high pressure*." If *all* the water had flashed into steam, the pressure would, no doubt, have been terrifically high; but only 1-160th part of it could have flashed into steam. There is novelty in the equation—

Low pressure + immense volume = terrifically high pressure.

In a postscript, Mr. Colburn refers to a volume of the *American Engineer* for 1857, to show that he dwelt strongly upon the distinction between rupture and violent explosions. Harshman did so before him, in his tract of 1855, and Mr. Colburn says he has read that book. I have today asked him to give me a sight of it, but he won't let me see it.

Respecting the historical summary of our communications, in Mr. Colburn's last letter, it abounds in chronological inversions and misstatements. I deny that I used an oath; I deny that I acknowledged appropriations from the *Engineer* in the *Encyclopædia Britannica*. But it is not my purpose, on this occasion, to attempt to exhaust the discussion; besides, I see Mr. Colburn leads off on a new tack—that would occupy a great deal too much of your space. But I again propose, as I have done before, to refer the whole matter under discussion to the decision of competent persons, and to abide by their decision. Meantime, as a fair summary, so far as it goes, and as a fair equivalent for Mr. Colburn's recapitulation, I subjoin a literal copy of a recapitulatory communication I made to Mr. Colburn, dated February 13, 1860:—

"*Summary of Events and Confabulations.*

"1. Jacob Harshman, U.S. (see the *Engineer*, August and September, 1859), said that when a boiler exploded, all the water exploded and disappeared, and a big cloud (in one case 15 ft. in diameter) arose in its stead. He recognized, as a common supposition, and discussed percussive action within the boiler. Said that explosion of mere gas or steam only was comparatively trifling. But steam with water, terrific.

"2. Z. C. and D. K. C. talked about this for two or three hours. Adjourned.

"3. Z. C. afterwards insisted that, in an exploding boiler, all the water flashed into steam of enormous volume (see Harshman). Also, that explosion of mere air or gas is trifling compared to explosion of steam and water (see Harshman again).

"4. D. K. C. wearied of this—(variations of Harshman)—scientifically absurd. Said that water could not all be evaporated, and inherent pressure could not be greater after than before explosion.

"5. Z. C. strangled all theories based on electric action, hydrogen, oxygen; and exploded them, as I thought, at once and for ever.

"6. Z. C. hammered at it, made no progress, wondered, and said there must be something yet, not understood.

"7. D. K. C. roused, said, though inherent pressure could not increase, yet the violent separation of steam and water would dash the contents like small shot against the surfaces of the boiler; and, in this way, by percussion, vastly increase the destructive action.

"8. Z. C. did not immediately adopt this, but did so soon. Asked D. K. C. if he really believed there was weight in the steam for the job. D. K. C. gave him various illustrations. Vastly pleased (that is, Z. C.). Z. C.'s faculties as compiler and lecturer set to work. Supposed to have written the lucid leaders about explosions that subsequently appeared in the *Engineer*.

"9. Explosion of the 'Great Eastern.'—D. K. C. gave Z. C. and A. L. H. his views on it, and the circumstances:—as want of stays, similarity of chimney to a large flue, head-pressure of water in stand-pipe greatly increasing the pressure at the lower end of the casing; similarity of collapsed chimney to a piston or plunger, and consequent rocket action; all of which were duly embodied in articles in the *Engineer* of the next Friday—to which my friends were perfectly welcome. D. K. C. explained also why inner and outer cylinder of casing burst at the same time—by collapse first, then reaction of water and steam rebounding on outer casing. Even then Z. C. was not at home with my [to him] new views. Confesses he did not understand them. Leaders on the 'Great Eastern' here and there misty. For example, why, if Z. C. knew all about rebounding of steam and impact at that time, did he call 400 lbs. per inch an incredible pressure? (*Engineer*, September 16, 1859, page 209.) He will try to explain this by saying he meant inherent still pressure. But, if so, why did he not in triumph bring forward the percussion theory? Because he did not appreciate it then. Galloway was right after all.

"10. In second leader on the 'Great Eastern,' *all* the water is supposed to be converted into steam after explosion. Z. C. says he wrote these leaders.

"11. Z. C., being, like many other excellent and capable engineers, in doubt and ignorance of properties of steam generally, was, about this time, frequently applying anxiously to D. K. C. for a proof of his article on *Steam*, written for the *Encyclopædia Britannica*.

"12. Frequent confabulations between Z. C. and D. K. C.

"13. Z. C. proposed a joint pamphlet. D. K. C. assented.

"14. Z. C. proposed to do it himself. D. K. C. resented being made a tool of. Z. C., having got primed by D. K. C. about the ('our') theory, and acquired a few clear views, thought he could go alone.

"15. But Z. C. cannot go alone. If leaders in the *Engineer* represent his views, he does not yet understand the theory. He seems a good compiler, assimilator, and (though violent) critic of other people's ideas, but cannot originate.

"16. D. K. C. conceived percussive action, or rather applied it to exploding boilers, not knowing at that time, nor till lately, what Harshman had been saying. D. K. C. afterwards glanced all through Harshman's paper (in the *Engineer*), and found Z. C.'s first proposed, but now cast off, ideas developed there, as well as the distinction between explosions of mere steam or gas, and those of steam and water together. Another idea put forward by Z. C. (see clause 3 *ante*). Did Z. C. borrow those notions from Harshman or not?

"17. Z. C. now repudiates those ideas—as to total disappearances and conversion of water into steam. Says he never entertained them (see clause 10 *ante*). D. K. C. does not pretend to know what Z. C. thought. He only knows what Z. C. said, and has read leaders in the *Engineer* on the subject, which Z. C. says he wrote.

"18. In the Mechanics' Magazine of the 10th inst., D. K. C. touched on one of the essential elements in violent boiler explosions, unappreciated by Z. C."

I am, Sir, your obedient servant,

D. K. Clark.

10, Adam-street, Adelphi,
October 21.

P.S.—I see Heenan has been sparring again with his back to the sun, without tossing for the corner, in the *Engineer* of last week. Mr. Colburn has another leader on boiler explosions, which I suppose I must accept as a rider to his letter last week, though he is careful to ignore the Mechanics' Magazine. But, as I have said above, he is off on another tack. He now attempts to prove that my account of the explosion on board the "Great Eastern" is all wrong; and he affirms that when the chimney collapsed, there could not be a sudden reduction of pressure by the sudden enlargement of volume (!!) except there was a rupture. This is a new—the third—explanation he has propounded. First, it was collapse alone; second, rupture alone; and now it is a combination of them both. Again, he questions the fact of the rebounding of the steam and water from the collapsed chimney, "as there is nothing to suggest it," says he—except, I may add, that the elastic mixture of steam and water closing upon the collapsed flue, would be suddenly arrested, which, in my opinion, forcibly suggests a reaction or rebounding. I have no present concern in following Mr. Colburn through his lucubration; it is exclusively devoted to an attempt to break down my theory of the violence of that explosion, probably with the object of weakening my claim to the origination of my projectile theory.

D. K. C.

NOTES FROM THE NORTHERN COLLIERIES.

COLLIERY ENGINE BEAMS.

A recent visit to Durham and Northumberland, in common with so many representing the science and manufacturing arts of Great Britain, whose steps were directed to Newcastle by the just concluded meeting of the British Association, enables us to place before our readers a few notices of the latest improvements made or projected in the coal trade—the grand staple of the north, and the material basis of all the rest of its mighty industries. Without coal, in the rich abundance, and of the fine quality in which it is won from the northern beds, the industries of the north could never have taken their existing *form* or reached their amazing development; but *with* the coal, a less intelligent, energetic, and persevering race might have slumbered on for ages of slow improvement, and left still the better part of "their talent buried in the earth." The Northumberland and Durham of to-day, is the joint result of great natural gifts, and of the good use made of these by one of the most magnificent races of men, intellectually and physically, that England, rich as she is in heroes, can anywhere boast of.

No peaceful calling, not even that of the mariner, is more heroic in its character than that of the collier—none that we can call to mind demands a larger amount of intellectual vigour, combined with physical prowess, or a more incessant need for vigilance, contrivance, and resource, nor any that affords field for the application of a larger amount of sound and true knowledge of physical science.

In this last respect our own observation leads us to regard the men of the North, who supply the brain that leads the masses of northern labour to the victories of industry, as sensibly in advance of the corresponding leaders in other parts of our country. It nevertheless seems to us that the educational apparatus by which applied science is disseminated amongst the new generation of the skilled leaders of industry, in the North, as well as everywhere else in Great Britain, is lamentably defective, and beneath the standard that is required to enable us to hold the place we have won amongst the workers of the world. To that subject, industrial education in Great Britain, we shall hereafter return, as to one full of the gravest interest and import to the people, polity, and position of England.

At present we but propose to ourselves some remarks upon a few separate subjects belonging to coal-mining. We shall treat them under consecutive heads, though without any attempt at scientific order or system. No text, even to the merely popular reader, is to be found more interesting, perhaps, than "the economy of a coal-field," nor one that more tempts a writer into diffuseness in his admiration of the innumerable expedients and contrivances, mostly upon the vastest scale, by which the coal, in spite of every natural obstacle and difficulty, is hewn from its bed, five or six times the height of St. Paul's in depth below the surface, and made to fly up into the light of day, and thence transferred from point to point with the minimum of labour, loss, or breakage, until it is finally burnt as the fuel of our own hearth, or in furnaces or manufacturing processes in all corners of the earth; in illuminating our assemblies and cities, in dissipating the freezing chill of Russian or Canadian winters, or bringing the steamship to its required haven, and the railway train to its destination.

We address ourselves, however, chiefly to those to whom such considerations, though they can never lose their poetry, are familiar, and to whom "the practical" is that which is at once the most useful and acceptable.

We shall begin, therefore, with some remarks on pumping-engine beams for collieries.

The dreadful accident of the breakage of the pumping-engine beam of Hartley Colliery on the 16th January, 1862, produced a decided and general *feeling* in favour of such beams being made of malleable iron only, instead of cast iron. In this feeling, we believe all experienced makers of pumping-engines and coal-mining engines are by no means unanimous. As a matter of *feeling*, and looked at with the lights usually brought to bear in writing a leader in the *Times*, the choice seems obvious and beyond question in favour of wrought iron; but we are not aware that the question has ever yet been considered in a way much more distinct and exact than this:—"Wrought iron is tougher than cast—the tougher thing will not break as easily as the brittle one—therefore, let us abandon cast iron for engine beams and adopt wrought." And the adoption has been carried out in some instances.

At Newcastle, at the exhibition of objects of scientific or other interest or novelty, produced at the Central Exchange, during the British Association's meeting—an exhibition whose character we may say in passing was highly creditable to Northumberland in every way—a model was shown by Messrs. Joicey and Co. (374), of a malleable iron beam for colliery pumping engines. It was a well-devised box girder beam, consisting of two vertical sides bounded by elliptical curves at top and bottom, and connected by a flat web plate all round, divided by diaphragms at various points, and provided with the requisite bosses, &c., for the several gudgeons or axes of the beam and of the parts of the engine. The joints, &c., being all double lapped and double rivetted. No doubt, as good a structure probably as could be put together of boiler plate, so far as could be judged from a model only to a small scale; but we submit that this does not decide the question whether wrought iron, in any form, be upon the whole preferable to cast iron, *applied in the best manner*, for such engine beams; and if so, whether boiler-plate work in any form be the best possible mode of applying wrought iron, whether it may not have itself, however convenient and cheap in formation, some special disadvantages; whether some far better form of wrought-iron work might not be conceivable; and finally, whether some material such as steel might not be superior to both cast and wrought iron.

We may not be able to enter upon all these points, and indeed might not be able to settle them; but preliminary to all other questions of the sort, it has always appeared to us that it ought to have been settled in the most scientific, positive, and *demonstrative* manner, how, and in precisely what way the Hartley beam (that originated by its fracture this proposed change of material) gave way—that is to say, that it was all-important to have discovered at the time of that accident, by the clearest chain of circumstantial evidence available, *how the fracture occurred*, and to have sealed the truth of the conclusion come to, as to the immediate cause, by *demonstrating, upon rigid principles, that the motions and forces so concluded upon, were sufficient to have produced the effect attributed to them.*

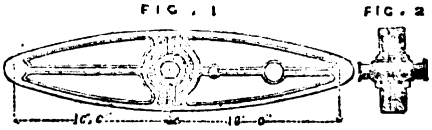
This, it appears to us, has never yet been done. The evidence given at the coroner's inquest had the usual amount of looseness and inconclusiveness, and at any rate, throughout it (as reported) no attempt to demonstrate, upon mechanical principles, the precise train of forces that caused the fracture, is to be found.

The official report made to Sir George Grey, Secretary of State for the Home Department, by Mr. J. Kenyon Blackwell, one of the Government Inspectors of Mines—a clear and able document upon the whole—*suggests*, rather than affirms, the train of causation that resulted in the fracture; but the author does not commit himself even to a clearly dogmatic affirmation of the cause, and makes no attempt whatever to demonstrate, on mechanical principles, whether what he suggests as having led to the catastrophe, was *adequate* to produce the results he is to be understood as having attributed to it.

This report of Mr. Blackwell's is, however, the most precise and authentic document, we presume, before the world on the subject of the Hartley beam breakage; and in view of a case so grave as this, one in which 204 persons perished as a consequence, it certainly does not reflect much credit upon British science, that an event so full of peril and agony of heart to many, and from which such lessons as should effectually avert a recurrence ought to have been educed, has been suffered to pass by unimproved, beyond what may be extracted from the merely suggested and undemonstrated conclusion of the report we have referred to.

Let us very briefly refer to the facts. The engine beam that broke was a double-flitched beam of cast iron of the form shown in figs. 1 and 2. It

FIG. 1 FIG. 2



was 34.5 ft. long from centre to centre of the end gudgeons; it was 8 ft. deep at the centre (according to Mr. Blackwell's report), 8 ft. 2 in. as stated by Mr. Short at the inquest, and 8 ft. 7 in. as given and figured in a contemporary and usually well-informed journal. In this singular discrepancy upon so important a point, we must accept the first as the only authentic statement. Each flitch was 4·75 in. in thickness, exclusive of the metal of the ribs and boss. They were pierced with an hexagonal eye, for the centre gudgeon, the diameter from side to side of the hexagon being 1·75 ft., and this centre of motion was 8 in. nearer to the end of the beam over the pit, than to the other at which the steam cylinder was placed.

The centre gudgeon was keyed in by large rectangular keys, driven (in pairs on each flat of the hexagon) by the sledge or tup, and with great force. The engine was a double-acting one, *i.e.*, it condensed at both sides of the piston; its stroke was 10 ft., cylinder 86·5 in. diameter, steam in boiler 14 lbs. pressure. It had at a previous period worked at 4½ strokes per minute, but at the time of the accident was working 7½ strokes per minute. We must presume it to have been regulated by a cataract, as we cannot suppose continuous work at the velocity of 90 ft. a minute, or even of 150 ft.; and, if so regulated, the velocity of making the stroke will have been nearly the same in either case, and then, the following passage in Mr. Blackwell's report is difficult to comprehend: "That liability to breakage existed in this engine was proved by a former accident which occurred in 1858, when its *speed* was only 4½ strokes per minute, instead of 7½ strokes, as at the period of this accident" (p. 31).

The engine worked three sets of pumps—two, one lower and one upper, in the pit shaft, both bucket pumps, of 2 ft. diameter working barrel, by 9 ft. 3 in. stroke. The dry spears were of Memel timber, from 14 in. to 10 in. square. The bottom set lifted the water 52 yards, to the other, which raised it 66 yards to the high main seam.

The third set of pumps were situated at the engine cylinder end in "a staple." They were bucket pumps also, 2 ft. 6 in. working barrel, 6 ft. 3 in. stroke, worked from the engine beam between the cylinder and beam centres. There was a counter beam and balance weight shackled on to the engine cross-head above the cylinder, to balance the whole system, as shown in the lithographs published at the time by Lambert, of Newcastle. This is also distinctly stated by Mr. Short, the engineer of the colliery, at the inquest—"the load of the engine is balanced by a counter beam." (*Times*, Feb. 6, 1862). But Mr. Blackwell does not mention this, and says the balance was produced by "the smaller weight of the top set in the staple, which was connected with the engine beam on the opposite side of its centre of motion to the bottom and middle sets, was compensated by the difference in length of the two ends of the engine beam from the centre of motion—the weight of the steam piston, the piston rod, cross-head, and iron catch-pin attached to the beam" (p. 30).

The pressure on the steam piston, by steam and vacuum, Mr. Blackwell says, was about 62 tons. The weight of the wet and dry spears, buckets, and columns of water in the two sets of pumps in the pit shaft (at the outer end of the beam) when the engine was about to make a stroke indoors, he states, was about 55 tons. Mr. Short, the engineer of the colliery, stated at the inquest that the weight of the engine beam itself was 42 tons, and "the total weight on the beam working both in and out," between 107 and 108 tons. He also stated, "the weight it had to lift, including the spears and the column of water, was 43 tons 18 cwt., and that the united weight of the engine piston, and rod, and cross-head, was 11,536 lbs. —rather more than 5 tons" (*Times*, Feb. 6, 1862.)

There is a good deal of discrepancy here between parties, both of whom must be deemed authorities. It would appear, however, that the active load upon the beam was something between 108 and 117 tons, and that its passive load was its own weight and those of its attached appendages in addition.

The beam had been cast at the Walker Iron-works, and Mr. Warence deposed that it was composed of ⅔ Blaenavon No. 3 cold blast iron, mixed with ⅓ No. 1 O.M.O. Scotch pig. It was also proved, we believe, to have been flasked, and not cast in open sand, as stated by Mr. Hoskings, C.E., at the inquest. The cast iron was examined at the School of Mines, Jermyn-street, and we are indebted to Dr. Percy for the following determination made of the amount of injurious constituents present in 100 parts of iron, and carbon, &c

Phosphorus	... ...	1·11
Silicon	... ...	2·68
Sulphur	... ...	0·16

The iron, therefore, was by no means bad in quality. The beam suddenly broke right through the eye, the fracture running in the direction marked in the fig. by a dotted line, and passing through the two diagonally opposite, sharp re-entering angles of the hexagonal eye—in this, as in every other case, showing that the fracture chooses not the very weakest *measured section*, which here would have been right across the beam, but the weakest place, section and quality of material taken together. Here through these angles, where "planes of weakness" were induced by the peculiar crystalline arrangement induced by the sharp angles of the eye.

The fracture showed no old crack, it was bright all over; adherent shreds of torn out iron, were remarked upon by one witness as a proof of the toughness of the metal; but no observation appears to have been made by any one with a view to determine which was the compressed and which the extended side of the beam at the time of fracture; whether by the position of these shreds above or below the axis, or otherwise; a most singular omission, when we bear in mind that the point most important to be determined in the first instance was, whether the beam broke by a force acting from below upwards at one end, or by one acting in the reverse direction, *i.e.*, whether by a concussion after the pump spears broke, or by a dead pull suddenly arrested. The fracture also showed four great "draws" or hollows left by the shrinkage of the metal as it consolidated. These were at the sides of the central bosses, where the solidifying iron remained last liquid in the mould.

The pump spears in the pit shaft were both found broken. Mr. Coulson, the veteran master sinker of eighty-four coal-pits, and whose voluntary and unremunerated exertions to relieve the buried men, along with those of his son and foreman, have made their names justly renowned, deposed that the fracture was about 14 fathoms from bank, in the main spears, and opposite the middle seam, *i.e.*, about 60 yards lower in the other spears; both he and Mr. Short appear to intimate that the fracture of the timber indicated *a pull asunder end on*, and not a cross fracture.

There appears some discrepancy also as to the quality of the timber, some of the witnesses at the inquest stating that at the fracture it was perfectly sound, an opinion that from personal communication we are aware is Mr. Coulson's also. Mr. Blackwell, however, states "the wood in the bottom dry spear near the place where it parted was found to be not perfectly sound" (p. 30).

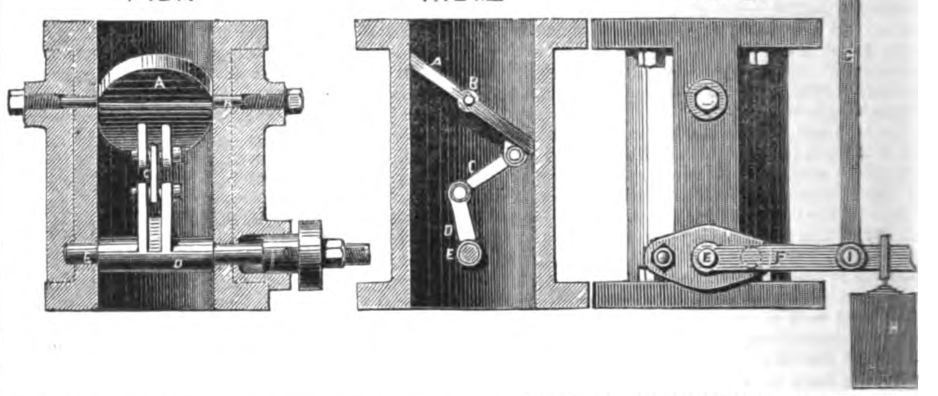
The engine piston, &c., had completed a down stroke after the beam had broken, the cylinder end of the beam had come down heavily upon the catches and spring beams, and the cross-head or piston cap had been fractured. The pumps in "the staple" had nothing wrong with them.

The outer end of the engine beam, on breaking off, plunged down the pit shaft, carrying the wooden brattice (which ran east and west, while the length way of the beam was north and south) crashing down into the shaft before it, and blocking up the latter with debris from the shaft lining, and the ruin of the pit work generally, at about 138 yards from the bank, where all were arrested by the oak buntons on which the middle set of pumps rested. With these details, or with the terrible circumstances of the imprisonment of the men and the heroic efforts made to release them, continued for long after they had been released from all bodily suffering by the easy death of suffocation by "the stythe," we have nothing here to do.

What we propose to consider, by the help of mechanics, how far confidence may be placed in either of the solutions that have been given of the precise train of forces that produced the accident, and then to draw some practical conclusions, amongst others, as to the comparative advantages and disadvantages of wrought iron or other beams, as substitutes for cast iron. For the mathematical treatment of the question, we are indebted to our distinguished friend and contributor Professor Samuel Haughton, Professor of Geology, and Fellow of Trinity College, Dublin. We must, however, reserve the continuation of the subject for following parts of the *Journal*.—*The Practical Mechanic's Journal.*

DUGDALE'S THROTTLE VALVES.

FIC.1 FIC.2 FIC.3.



DUGDALE'S IMPROVEMENTS IN THROTTLE VALVES.

The object of this invention, patented by Mr. A. Dugdale, of Paris, engineer, relates to an improved method of mounting and actuating throttle valves. As now practised the throttle valve is worked direct from the governor, a rod from which is connected to a lever or arm on its spindle.

This arrangement is open to objection, inasmuch as it causes the spindle to wear loose in its bearings in consequence of the continual friction to which it is subjected.

In order to remedy this serious evil the patentee arranges the valve in such manner that the pin upon which it is mounted or turns shall be entirely independent of the actuating parts, and shall serve merely as a pivot for the valve to turn upon, the parts for transmitting the movement of the regulator being connected to one extremity of the body of the valve, and not, as in the plan now in use, connected to the valve shaft.

This arrangement is represented at Figs. 1, 2, and 3 of the accompanying drawing; figs. 1 and 2 being longitudinal sections taken through the middle of the steam pipe, provided with its throttle or regulating valve, which in these two figures is shown in the position in which it would be in order to completely close the steam pipe; fig. 3 is an elevation or exterior view of the steam pipe, showing the parts for actuating the valve. In these three figures corresponding parts are indicated by similar letters of reference.

In the improved arrangement of throttle valve the body A of the valve turns upon a pin B passing through its centre; the valve A is actuated by means of a link C connected to a forked arm D mounted upon the shaft E. Upon this shaft, but outside the pipe, is a lever F hinged at I to the actuating rod G. The lever F is provided with a moveable weight H for the purpose of acting upon the valve. The figures show the manner in which the different parts are mounted in the steam pipe, and it will be seen that in this arrangement the pin B being placed in the middle of the thickness, and in the line of the smallest diameter of the body A of the valve, this pin must necessarily in all positions be subjected to about the same pressure, and allow the plate to turn freely as upon a hinge or two pivots.

Toothed sectors, or other equivalent mechanical arrangements, may be employed instead of the connecting-rod or link C and arm D for transmitting the movement of the shaft E to the valve.

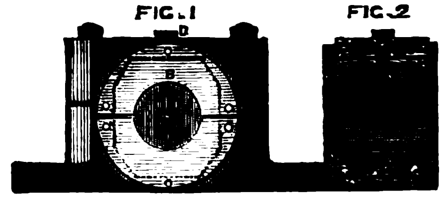
BURTON'S IMPROVEMENTS IN SHAFT BEARINGS.

Mr. J. W. Burton, of Leeds, has recently patented an invention which has for its object the combination of the materials hereinafter stated, so as, when combined, to form a substitute for the materials hitherto employed for the purpose.

The bearing, or part on or against which the axle or shaft-works, is composed of glass or other similar hard and smooth material or composition, and the flanges or ends or outer parts are composed of brass or other suitable metal or alloy, and there is inserted between the bearing and the flanges or ends pieces of wood, papier maché, felt, india rubber, cloth, or other similar non-metallic and partially elastic substance or material. The several parts are united as required by means of countersunk bolts, or in any other convenient manner. By this combination of materials there is provided a hard and smooth bearing of a more permanent character than those in ordinary use, resting at each end against a kind of cushion of partially elastic material.

Fig. 1 in the accompanying drawing is a side

FIC.1 FIC.2



elevation of a plummer block or bearing for a shaft or axle; and fig. 2 is a transverse section of the same. A is the bearing or part on or against which the shaft or axle works, and is composed of glass or other similar hard and smooth material or composition; B, B, are the flanges or ends, composed of brass or other suitable metal or alloy, which form the outer part or casing of the bearing A. Between the parts A and B are inserted pieces of wood, papier maché, felt, india rubber, cloth, or other similar non-metallic and partially elastic substance or material C, shown by dotted lines in fig. 1. The parts are shown as connected together by means of countersunk bolts. D is an ordinary oil cup. It will thus be seen that by means of the above-described combination a shaft or axle inserted in the plummer block in the usual manner would be provided with a hard and smooth bearing of a permanent character at A, resting against a kind of cushion of partially elastic material C, enclosed by the metal flanges or casing B.

PERFORMANCE OF AMERICAN IRON-CLADS.

The following interesting communication from an engineer in the United States Navy has appeared recently in a New York paper. This gentleman, writing from his ship, off Charleston, says:—

Those who are interested in the success of our iron-clad navy will be pleased to hear of the invulnerability of the pioneer of our ocean iron-clads the "New Ironsides." Of the 213 shot and sh-

that have struck her during the attacks on Charleston, none have caused any serious injury to life or limb, nor any apprehension for the safety of the vessel. The most probable source of danger is from a shot or shell entering the ports. Each port is protected by two port shutters, which are wrought-iron plates that shield the port, on the same principle that the plate covers and uncovers the keyhole of a lock, except that the hinges are on the inside upper corners, instead of the centre of the top of the plate, as in the lock. Although these port-shutters are 5 in. thick, they cannot resist the impact of a shot which strikes them while they cover the ports; and, in proportion to their bending, is the difficulty of working them.

The hinges have so little metal around them, that, if a shot strikes them, the shutters almost invariably drop off. Both of these defects, however, can be easily remedied. The rebels have paid particular attention to the water-line and machinery of the ship. The water-line bears the imprints of ten 10 in. solid shot. The most serious damage resulted from two shots striking the same plate, within a foot of each other, and within a foot of the end of the plate. The result was, the partial cracking of the plate, bending it, and forcing it about an inch into the woodwork. It occasioned no leak in the vessel.

The method of fastening the plating to the sides of the ship is very effective. It consists of common wood-screws, put through the plates from the outside, and tapped into the wood, having cylindrical heads countersunk into the plating and flush with the outside. Several of these screw-bolts have been struck directly on the head without causing any damage, whereas, if the ordinary plan of using through bolts or rivets had been adopted, it is very probable that some persons would have been injured by fragments of the bolts being projected inside the ship. Captain Badger was seriously wounded while in the turret of the "Patapsco," by being struck by one of the bolts that held together the several plates that compose the turret. Several 10 in. solid shot, and one 11 in., have passed through the unprotected part of the bow and stern; but so much of their momentum was lost in the passage, that they did not reach the wrought-iron bulkheads that cross the ship forward and aft, and which would have effectually stopped their further progress. The 11 in. shot came from one of the guns of the ill-fated "Keokuk." It was originally a poor casting, and the rebels apparently had to turn one-half of it in a lathe before it would fit the gun.

The appearance of the smoke-stack indicates good shooting on the part of the rebels. A dozen shots and fragments have passed completely through it, all of them within 15 ft. of the deck. One shot would, undoubtedly, have passed into the boiler, but that it was deflected by the wrought-iron grating in the smoke-stack, placed there for that purpose. The projecting woodwork on the spar-deck is torn into shreds, and one-third of the rail is completely carried away.

It is claimed for the "Ironsides" that she is equivalent to any six of the "Monitors." It is certainly the case that when she brings her broadside to bear, and opens fire on the rebel batteries at a thousand or twelve hundred yards range, the rebels very soon leave their guns and take to their bomb-proofs. They have so much respect for her shelling propensities that, although often at anchor within their range, taking in ordnance or coal, they do not disturb her. An idea of her capacity for distribution may be formed from the fact, that in the attacks since the 7th of April, she has fired 4,439 shells, 3,333 having been fired at Fort Wagner.

Of the machinery it may be said that it combines, with neatness of design and excellency of workmanship, that most essential requisite in the machinery of an iron-clad—simplicity. It consists of two horizontal direct-acting engines, with one surface condenser in common, and a double-acting air and injection pump to each engine. A double-ported balanced steam slide valve to each engine, cutting off by the lap at two-thirds of the stroke of the piston, and each worked by a link motion, constitutes the principal porti n of the machinery. Four horizontal tubular boilers furnish all the steam required. The engine-room is the finest of any screw-ship in the service, while the fire-room is about the most uncomfortable of any vessel of her class. During a late attack, with the fires spread, and the furnace doors open, the temperature was 170 deg. This is, of course, the extreme; the ordinary temperature, however, being 120 deg. Two blowers with their separate engines, are arranged to supply air to the fires, or to force air on the gun-deck during action. The latter is the only purpose for which they are used. The greatest defect in the ship, not connected with its invulnerability, is the want of ventilation on the berth-deck. The ward-room has the benefit of a windsail and air-ports; but the steerage, in which 17 officers have to live, has no ventilation whatever. Each room is nothing better than a box. Officers enter their mess-rooms, eat their meals, and then rush on deck to get fresh air. There is not even a windsail, although there are two hatches, communicating with the spar-deck, in which they could be placed. An expenditure of a little time, and less money, applied to the construction of air-tubes leading to the blowers, with branches leading into each room, would result in the officers' enjoying health and comfort.

An Engineer in the U.S.N.

ENGINES OF THE "PURITAN" AND "DICTATOR."

These two magnificent vessels of war, now fast approaching completion, will certainly be unsurpassed in their speed and invulnerability. We do not suppose that twenty miles per hour will be got out of them, as is stated; but we do think that three-fourths of it is not too much to expect when their models and engines are considered. We have had an eye on the construction of the machinery for some time, and have taken great interest in it. The following details will be found of general interest:—The cylinders are 100 in. in diameter, and the piston has 4 ft. stroke; they are "kettle-bottomed," being cast solid, of the same shape as that utensil named; they are 2½ in. thick through the sides, and have 4 strong lugs by which they are held to their places. They stand vertically, and have no bed plates; in fact there are none for the whole engine, but the cylinders are bolted to two massive wrought-iron kelsons, 10 ft. deep and some 24 in. or more in width; four huge bolts secure each cylinder to the kelsons. The cylinders are both in line, athwartships, and have large slide and expansion valves, the latter working over the former; in each valve there are two stems which proceed to strong cross-heads working between vertical guides on the end of the steam chests. The chests are bolted, not cast, to the cylinders.

A peculiar feature of this machinery is the absence of guides, cross-heads, and other cumbrous parts. The piston has a trunk attached to it, but the engines are not, strictly speaking, trunk engines. The usual connection is attached to the bottom of the piston, runs up the trunk, and takes the end of a lever attached to a vibrating shaft running fore and aft; this shaft transmits the power of the piston to the propeller or screw shaft; it is supported in wrought-iron blocks, with brasses, as usual, and has a vertical lever placed on it, from which the main connecting rod proceeds directly to the crank pin; these are the principal parts. The vibrating shaft blocks are bolted to the kelsons (of which there are six in all), and there is one shaft to each cylinder, making two shafts, two connecting rods, and two trunks between the pistons and the crank pin. The air-pump is placed inside the condenser, and worked by a lever on the end of the vibrating shaft. The condenser is of the old-fashioned jet variety, and sits directly aft the cylinders. The shaft is 21 in. in diameter, is 72 ft. long in several sections, and works in a tunnel or alleyway made for it.

The boilers have 56 furnaces, and an aggregate grate surface of 1,100 ft.; allowing 12 lbs. of coal per square foot of grate surface, the vessel will require at the least 175 tons of coal per day, of 24 hours steaming, at full speed.

These engines are precisely similar in all respects for each vessel; the propeller is 21 ft. 6 in. in diameter, has 32 ft. pitch, and weighs 39,000 lbs.; there is no out-board bearing for the shaft. What piston speed will be obtained from the engines remains to be seen; we hope that the highest expectations of the builders, and the designer, Captain John Ericsson, will be attained.—*Scientific American.*

TRIAL OF ARMOUR PLATES, STEEL GUNS, &c., AT ST. PETERSBURGH.

On Wednesday, the 17th of October, N.S., further trials took place at St. Petersburgh with the experimental 9-inch rifled cast-steel gun. The *Times* states that this gun is of solid cast steel, made by Krupp, and throws a 300 lb. shell or a 450 lb. solid shot. The results of previous experiments with this gun led the Russian Government to order 50 of them, which are now in course of delivery. The principal objects of the experiments on the 7th inst. were to ascertain the best description of shell, and to test the quality of armour plates supplied by Messrs. John Brown and Co., of Sheffield.

First, a series of cast-iron shells, 300 lb. each, were fired at different ranges, and then shells made by Krupp were fired at the 4½-inch armour plates. The first shell, of hard cast steel, was 22½ in. long (two and a half diameters), with a flat end 4 in. in diameter. Fired with 50 lb. of powder at 700 ft. distance it passed through the plate, oak and teak backing, and broke into many pieces, although filled with sand only. The second and third shells were also of Krupp's steel, the same length, but with 6. in. ends. These shells pierced plates, wood, &c., and also went to pieces, although only filled with sand. The fourth shell was made by M. Poteleff, of puddled steel, on Aboukoff's system, the same dimensions as the second and third, and went through iron, teak, &c., but was only bulged up from 9 in. to 12 in., and the end flattened; not a single crack being visible in the shell. The fifth shell, the same as the fourth, passed through iron, teak, and the second target, and went at least a mile beyond. The sixth and seventh were from Krupp, and were charged with powder; they were quite flat-ended, 9 in. diameter. One exploded in the plate, the other in the wood. The eighth and ninth shells, were of cast iron, and, although they passed through the plates, were of course destroyed. Evening prevented further trials, which will yet be made on the same plate.

The results on the plate were highly satisfactory. In a space of 4 ft. 6 in. by 3 ft. 6 in. eight holes were made without any crack of the slightest description; and the marine officers present were highly satisfied, because they are obtaining 4,000 tons of plates from Messrs. John Brown and Co. for their different ships.

The English Government would do well to note the progress the Russians are making in gunnery. Cast steel guns are decidedly before any yet produced in England of any other metal. The 9 in. gun of Krupp has been fired with 300 lb. shells and 50 lb. of powder about 70 times without any flaw, and the Russian Government will shortly be in a position to obtain in St. Petersburgh a large supply of cast-steel guns, made from Russian iron, by Russians, on Aboukoff's system, which is very near the same as Krupp's.

THE DUMMY ENGINE.

The public prejudice against street railways has been overcome; and the communities now enjoying their advantages would look upon the removal of the roads as an invasion of their rights. There is one other prejudice to be removed; and until it is, the mission of the street railway will not be perfectly fulfilled. Property owners along railroad routes object to the use of the "dummy," or noiseless steam engine. The railway companies themselves share in the antipathy. This is no novel fact; for the very parties to be most benefited by any great new inventions, have usually opposed most fiercely their introduction. The "dummy" engine has been thoroughly tested in several parts of our country, and has everywhere proved an unqualified success. In New Jersey, from Jersey City to Birgen Point, it has undergone the practical trial of several months' daily use, and has demonstrated these facts:—That one small engine, occupying no more space than a chest of drawers, in the front partition of the car, and entirely concealed from external view, will draw as many passengers as ten horses; that it will draw them two or three times faster than horses, if necessary; that the expense, including wear and tear, is less than that of horses; that the engine throws no sparks in the air, consumes its own smoke and makes no noise; that it can be stopped in less space than a horse can, removing thereby liability to accidents; that the roads are kept in a cleanlier state; and as the business of the road has been increased since the introduction of steam passenger cars, that passengers prefer them to horse cars. The greater cleanliness of the streets is a stronger reason for adopting this kind of car in cities than in less populous places, but is of little weight in comparison with the saving of horse-flesh and the consumption of feed which would result from the general introduction of these cars. The saving of the feed of the horses now required for railroads, would cheapen the cost of feed. Pennsylvanians are interested, as a new source of consumption for the product of their coal mines would be presented. Those who, as legislators or acting in other public capacities, plane the way for and remove obstacles to the successful introduction of steam passenger cars will, when greater facilities are afforded for travel, and fares cheapened, be regarded by the public as benefactors.—*Phil. Ledger.*

WILDE'S ELECTRO-MAGNETIC TELEGRAPHS.

FIG. 1

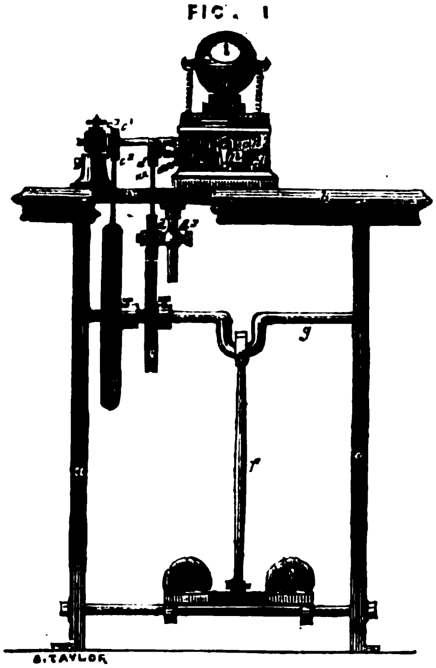


FIG. 3

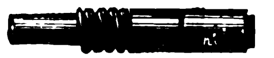


FIG. 4

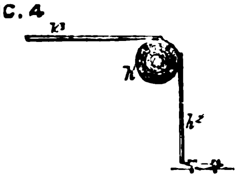


FIG. 7

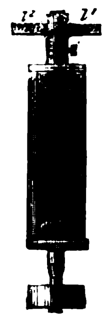


FIG. 2

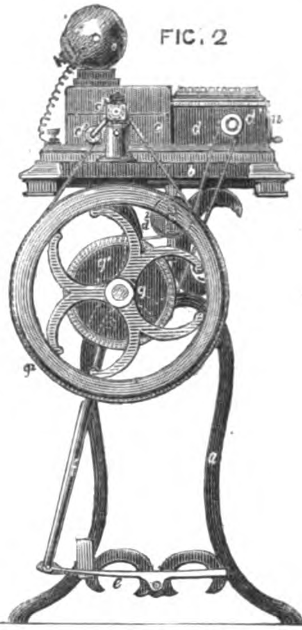


FIG. 5

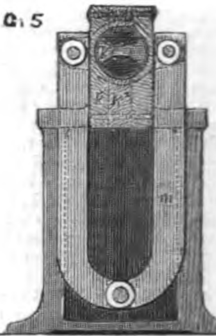
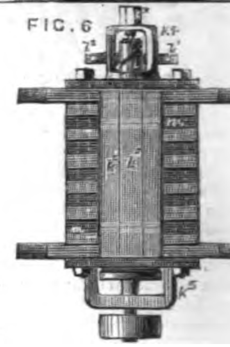


FIG. 6



WILDE'S IMPROVEMENTS IN ELECTRO-MAGNETIC TELEGRAPHS.

LETTERS PATENT have been recently granted to Henry Wilde, engineer, of Manchester, for improvements in electro-magnetic telegraphs. This invention consists in improvements in the transmitting instruments described in the specification of Letters Patent granted to Mr. Wilde in the year 1861.

In the specifications of these patents transmitting instruments are described, in which the armature of a magneto-electric machine is mechanically geared with a radial arm, which travels beneath a series of finger-keys, any one of which being depressed arrests the motion of the radial arm, and also the motion of the armature with which it is mechanically connected.

In the present improvement the alternately "inverted" currents (or currents passing in opposite directions) generated during the continuous revolution of the armature of a magneto-electric machine are made to pass in one and the same direction by means of a "commutator" or current changer of the ordinary construction placed on the armature or other axis connected with the ends of the wires in which the currents are generated. These "direct currents" are then transferred by means of wires to another commutator, by which the currents are again inverted previous to their passing into the telegraphic circuit. This last-mentioned commutator is made to revolve more slowly than the other, so as to allow a greater number of the direct currents from the first-mentioned commutator to pass into the telegraphic circuit before the currents are again inverted. From the relation which the more slowly moving commutator bears to the more quickly moving commutator of the magneto-electric machine, it is called a differential commutator. This differential commutator is fixed on the axis which carries the radial arm and index finger of the transmitting instrument, and is so constructed as to invert the direct current from the other commutator as many times as there are letters or signs on the dial of the indicating instrument.

Fig. 1 is a front elevation of an alphabetical dial telegraph, to which the improvements are applied; fig. 2 is an end view. *a*, *a*, are the standards, and *b* the table on which the magneto-electric machine *c*, and the transmitting instrument *d*, are placed, which are driven by a treadle, connecting link, and crank shaft *g*, on which is fixed the pulley g^1 for driving the pulley d_1 fast on the commutator shaft *h* of the transmitting instrument. The tension of the band passing around the pulleys is regulated by the pulley d^2, mounted on a stud which is adjustable on a slide pillar.

The transmitting instrument is similar to that patented by Mr. Jacob Brett in 1848, with this exception, that in the present arrangement the currents are inverted by means of the "commutator" *h*, seen best in figure 4, whereas in Brett's patent they were only interrupted by means of a make and break wheel.

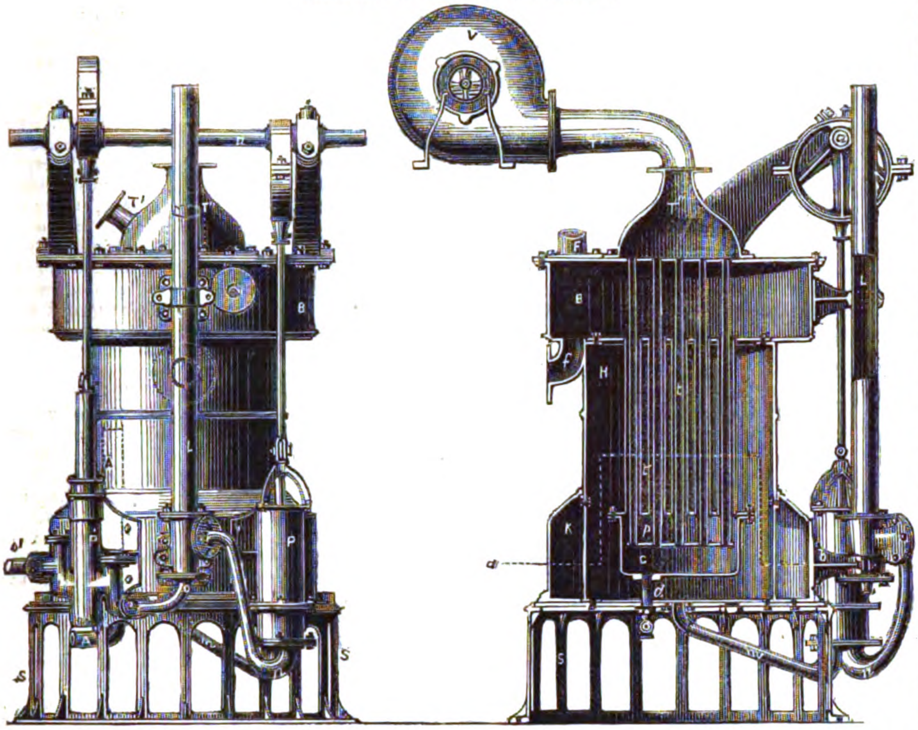
In the present arrangement the radial arm travelling beneath the finger-keys is driven by a worm and worm-wheel. The springs h^2 and h_3 are respectively connected to the line and earth wire terminal screws *j* and j^1.

The magneto-electric machine is shown in detail in figs. 5, 6, 7; in these views it is shown supported in a frame for the purpose of being driven by a separate moving power, whereas in fig. 2 it is attached to the table, and it is driven by the same moving power as the transmitting instrument. The cylindrical soft iron armature *k* is grooved at each side to receive the coils of insulated wire wound in the direction of the axis of the armature, and the armature shaft *i* is connected to the armature *k* in the usual manner; to the other end of the armature is connected the stud of the "commutator" *l*. This commutator is formed of two cylinders of hardened steel insulated from each other, and instead of being cut parallel to the axis, is cut diagonally in order that it may run more freely over the springs bearing upon it; the armature *k* revolves in a cylinder formed of the two outer pieces of iron k_1 and the intermediate piece k^2, made of brass or other non-magnetic substance, and the bolts by which the three pieces are connected are also made of non-magnetic substance. The horse-shoe magnets *m* are connected to the iron pieces k_1 by bolts. The armature *k* is kept concentric with the commutator end of the magnet cylinder by the tail pin k^3 passing through the brass cross piece k^4, and at the other end by a conical shoulder on the shaft passing through the brass cross piece k^5. The end of the armature shaft *i* is supported in an adjustable bearing to keep the armature concentric with the magnet cylinder. The switch *n* when turned against the stop n_1 short circuits the coils of the magneto-electric machine until the crank shaft *g* has acquired its regular motion, after which it is again brought into the central position shown in fig. 1, and the coils are then in direct communication with the line wire and indicating instrument *o*.

The mode of operation is as follows:—Motion is given to the armature *k*, which produces two currents or shocks for each revolution; these currents after being made to pass in one direction by the commutator *l*, are transferred by means of the springs and wires l^1 and l^2 to the spring l^3, and to the metal base of the transmitting instrument, which are respectively in connection with the separate and insulated parts of the commutator h^1; motion is also given simultaneously to the commutator h^1, and the relative speed of the commutator *l* and the commutator h^1 is such that the currents proceeding from the magneto-electric machine are produced about one-fourth faster than they are inverted by the commutator h_1. When the magneto-electric machine is driven by steam or other separate moving power the currents may be produced relatively faster than is necessary when the magneto-electric machine and the transmitting instrument are driven by the same moving power, for the purpose of keeping the speed of the former in excess of the latter when the most expert operator is working the instrument. Wires are connected from the place where the magneto-electric machine is driven to the transmitting instrument *d*, which is driven by the treadle *e*, as above described.

When the machine, shown in figs. 1, 2, 3, and 4, is in operation, the inverted currents from the commutator h^1 pass into the telegraphic circuit and act upon the indicator *o*, until the radial arm is arrested by the depression of a finger-key which stops the commutator h^1, and prevents the currents from the commutator *l* of the magneto-electric machine from being inverted. These currents then pass into the telegraphic circuit in one direction only, and from the well-known construction of the magnetic apparatus connected with the indicator which requires inverted currents to produce the rotary motion of an index around the dial, the direct currents from the magneto-electric machine will not produce any effect on the indicator, and the index of the indicator will therefore remain opposite the letter required so long as a finger-key is pressed down. When the pressure of the finger is removed from the key, the commutator h^1 again inverts the currents which actuate the indicators until the commutator is again stopped by the depression of another key. During the depression of a finger-key the band slips over the pulley d^1 in the usual manner, while the driving shaft *g* and armature *k* continue their motion as before.

DATICHY'S STEAM ENGINES.



DATICHY'S IMPROVEMENTS IN STEAM ENGINES.

THE object of this invention, patented by Jean Datichy, of London, engineer, is to utilize the steam after it has produced its effect in the cylinders of steam engines, by passing it into and through condensing apparatus, consisting of tubes surrounded by water alone, air alone, or by air and water, the air being forced in by a fan or blast, and the water, when water is used, being allowed to trickle down the outside of the tubes in a case surrounding them, which water rises, overflows, and entering a double casing, escapes, and is returned to the supply cistern. The steam being more or less condensed, is forced by suitable pumps into the boiler directly or through a coil in or round the casing of the boiler, whereby it becomes heated before entering the boiler. The condensers consist of jacketed cylinders, containing within them another casing, in which are tubes, into which the waste steam from the cylinders is made to enter; or the patentee reverses the position of the steam and of the air and water, or air or water—that is to say, he causes the air and water, or air alone, or water alone, to pass through tubes contained in a casing or cylinder into which the steam to be condensed is admitted.

Fig. 1 of the accompanying drawings is an elevation, and fig. 2 a section through the line *c*, *d*, of fig. 1, of a condensing apparatus and parts connected therewith, constructed according to this invention.

H is a chamber in which the condensation of the waste steam is effected; A is a pipe leading the waste steam into the chamber H; V is a fan for forcing in air; and T, the fan pipe; T^1, fig. 1, pipe for the introduction of water; T^{11}, reservoir for air and water; *t*, *t*, *t*, are tubes through which the air and water descend into a receiver G; *p* is a perforated plate separating the tubes *t*, *t*, *t*, and through which the air and water re-ascend into other tubes t^1, t^1, t^1, encasing the tubes *t*, *t*, *t*, and which lead the air and water into an outlet case or chamber B; F is a pipe for the escape of the air, and *f* a pipe for the passing off of the water; K is a chamber protecting the bottom of the chamber H from contact with the external air; P is a suction pump for the condensed steam, and *m* the suction pipe of the same; *n*, force pipe of the pump P; L, atmospheric column; P^1, pump for forcing the steam into the boiler; O, suction pipe on the column L O^1, pipe through which the condensed steam is forced into the boiler; *a*, shaft for the transmission of motion; S, frame supporting the apparatus; *d*, emptying cock of the receiver G of the tubes *t*, and t^1, and of the case B; D, emptying plug of the chamber H.

The action is as follows:—The steam from the cylinders of the engine enters the chamber H through the pipe A, and becomes partially condensed by immediate contact with the tubes t_1, which are kept cool by a current of a mixture of air and water, or air alone, or water alone. The air is forced in by the fan V through the pipe T, and the water enters by the pipe T^1. The air and water become mixed in the reservoir T^{11}, and pass therefrom together into and through the small tubes *t* into the receiver G, and re-ascend, through the perforated plate *p*, into the tubes t^1, from which they pass into the case B, which has two escape pipes; the air and water pass off by these pipes into a reservoir provided for the purpose, and is returned to the supply cistern. The condensed steam is drawn from the chamber H by the pump P through the pipe *m*, and is forced through the pipe *n* and column L, while at the same time the pump P^1 draws it through the pipe O into the pipe O^1, which leads it to the boiler; this pipe O^1 is coiled or of serpentine form, and the patentee prefers to place it in stationary and marine engines in front or behind the furnace, and in locomotive engines in the smoke-box, by which means the water or condensed steam becomes re-heated before entering the boiler.

BROWN'S IMPROVEMENTS IN THE MANUFACTURE OF ARMOUR PLATES.

THE following improvements in the manufacture of armour plates have been recently patented by Mr. T. Brown, of Sheffield, being a communication from Alexander Holley, of New York:—This invention has for its object improvements in the manufacture of armour plates for ships and other structures. For these purposes plates of wrought iron are piled one on the other, having between them crushed or pulverized franklinite, spiegel iron, or similar metal; this pile is heated to a suitable degree to cause the franklinite, spiegel iron, or other similar metal to assume a pasty or melted state, and the wrought-iron plates to be brought to about a welding heat, so that when rolled or pressed the parts of the pile will combine. The rolling is to be continued till the mass is reduced into a plate of any desired thickness. A series of such compound plates are piled one on the other with pulverized franklinite, spiegel iron, or other like metal between them, and this pile is to be heated and rolled, or pressed, and reduced to the desired thickness, either for an armour plate, or for being again piled with other plates, as above explained Fluxes may be used when found desirable.

AN ENORMOUS PAIR OF SHEARS.

MESSRS. TANGYE, BROTHERS, AND PRICE, of the Cromwell Works, Parade, have just completed, for the Russian Government, an immense pair of shears, weighing four-and-twenty tons, having a power of pressure equal to a thousand tons, and able to snip to pieces a cold bar of iron half a foot square. The contrivance is technically described as a "horizontal hydraulic shearing machine, with open mouth;" and it is said to be, if not the largest, at least, the most powerful article of the kind ever made. The cylinder is of wrought iron, and is hooped to increase its strength; it may be removed, and used as a hydraulic press of a thousand tons power; the machine is fitted with valve arrangements to reverse itself at any length of stroke; may be set to cut iron from ½ in. thick to 6 in. thick; when at full power it will cut a bar of iron 6 in. square in forty seconds; the return motion is six times as fast as the cutting motion. To this it may be added that the casting weighs eighteen tons, and that the fittings weigh about six tons. The piston is of cast iron, and is 16 in. in diameter; and it fits into a square block of wrought iron, which carries one of the cutting blades, the other being fixed into the solid casting, and both being 14 in. long, 11 in. deep, and 3½ in. in thickness. The blades are of hardened cast steel. The force-pumps for the machine work on the horizontal principle, and are so arranged that they can be set to any power, and being set to that power cannot go beyond it, but as soon they reach it retreat. The machine is made for the Russian Government, and it is intended to be used as a "scrapping machine" in a large ironworks in the neighbourhood of St. Petersburgh. To the unlearned in such matters the machine looks for all the world like some mechanical behemoth, or an immense megetherion, resuscitated from the fossil state by galvanism, and set to work for the benefit of us moderns. It is a great deal bigger than an unusually large elephant, and not half so comely in its proportions. Its jaws, so to speak, are at the nape of its neck—two broad edges of steel standing upright, and facing each other. One of them only can be moved, and that is moved in this way:—Along the animal's back runs a huge backbone of iron—round, solid, and capable of sliding backwards and forwards. To this backbone is affixed, between the shoulders, a square block, also of iron, and also moveable, and into this block is fixed the jaw of solid steel. All you have to do, therefore, is to push the backbone at the end farthest from the jaw, and the jaw at once moves forward in the direction of its opposite neighbour. The pushing is done by water power—a power so great, that dropping a solid bar of iron 6 in. in thickness into the creature's mouth, and thrusting the jaw forward, either the bar of iron must come in sunder, or the jaw break and the animal itself fall in two. There is no resisting it. The power is awful, and the resistance of the solid parts of the animal and its steel teeth scarcely less so. We saw it yesterday. It crunches up iron like we mortals crunch up a salad. If it break the machine, the pieces will fall there and do no distant damage; you can take off the power instantly, and there is no momentum to do further harm. So much as to the machine itself. Comparing it with others it is doubly as powerful, so we are told, as any machine of the kind previously made—that is to say, that while nothing has ever yet been invented that would cut a bar of more than 3 in. in thickness, this will cut one of 6 in. The body of the machine, the solid casting—and it is all in one piece, excepting the moveable parts to which we have referred—is made of cannon lost in the sea during the great siege of Gibraltar by the Spaniards; so that guns used to decide the fate of nations, and lost during one of the most famous sieges in modern history, have been fished up from the bottom of the sea and fashioned into shears to cut old iron to pieces for the furnace. Truly, we may say with Hamlet, "To what base uses may we come, Horatio!"—*Birmingham Post.*

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—T. B., W. T., C. K., J. E. C., L. K., B. F., B. M., R. O. L.

P. M. (Birmingham).—We believe there would be a decided advantage in the use of lead instead of zinc as you propose, but all attempts to coat iron with lead in a satisfactory manner have hitherto failed. If you can really do all you state, your invention should be very valuable.

T. WALKER (Birmingham).—We do not understand your question: do you mean feathering paddles? We have seen models of wheels in which the floats were always vertical, but we know of nothing of the kind in actual use. If you will be a little more explicit, we will endeavour to get you the information you want.

T. W. B.—You will find the slide rule answer your purpose, perhaps, better than anything else. A few hours' instruction would enable you to understand it sufficiently for your purpose. There is no such book as you want for sale at a small price.

ERRATUM.—In the article on "Cleaning Ship's Bottoms," which appeared in our paper last week, for "Mr. M. Hutchinson" read "Major-General Hutchinson."

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In your leading article of the 9th inst., on Twin Screw Steamers, it is stated that Capt. Carpenter only used one engine. Permit me to say that this is a mistake, for in the year 1851 I made the machinery to his order and from his plan, for three models 3 ft. 6 in. long. This consisted of two separate engines, one to each screw, and working entirely independently of each other.

Capt. Carpenter gave me these reasons for adopting this plan:—1st, the screws could be used to steer with; 2nd, that by reversing them the ship could be turned on its own centre. These things the model fully illustrated. In his printed circular, which is now before me, he says:—"The shafts lie in a line with the direction of the keels to each propeller, with a connection to the engine or *engines*."

My apology for writing to you, Mr. Editor, is that the captain is dead, therefore cannot answer for himself; and as I know that you are always most anxious to award the honour of an invention to those to whom it is due, I venture to hope that you will find room for this, or a portion of this letter, in your valuable journal.

I am, Sir, your obedient servant,
HENRY CHAPMAN.

2, Owen's-row, St. John-street-road,
Oct. 19, 1863.

Correspondence.

GUNNERY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Your correspondent "Civilian" hopes that, in putting forward his opinions on gunnery, he is not presumptuous; his object being, he says, "to promote discussion and elicit truth;" and undoubtedly his communications do tend to *provoke* discussion at any rate. I am honestly of opinion, that "Civilian" would make a very useful writer on practical matters, if he would only take the trouble to ascertain the extent and character of what has already been determined concerning the theme on which he writes, and not substitute his own fancies for its acknowledged scientific principles. As an example—referring to his communication last week—of the direction in which knowledge and self-improvement may proceed, the following opinions, as revised and amended by him, will suffice. They are these—that "the momentum of projectiles" is *not* "in the ratio of the square of velocity multiplied by the weight"—that *vis viva* is *not* a synonyme for velocity, nor *vis inertia* for weight—that *vis viva* is not "a more important element than weight," seeing that weight is one of the constituents of this so-called element, the other being that law of the velocity which he ascribes to momentum—that the products of weight into the square of the velocity, when "giving equal quantities, ought [*not*] to indicate equal effects" in the way of penetration by shot, unless the areas of impact are equal—that the inequality of effects as found in practice is owing to a want of similarity in this circumstance of the case, and *not* to "a more important element than weight" misnamed *vis viva* and velocity indifferently—and that "the long range at which the Charleston forts have been shelled is [*not*] simply ascribable to the application of the rifle principle," but to the application of rifling to guns, merely as a practical expedient, to secure the parallelism of a long projectile to the end of its flight; the greater extent of its range, in comparison with a spherical shot, being due, *not* to its revolutions on its axis, but to its greater weight, and to its encountering no greater resistance from the atmosphere, probably, than the ball. With the same charge of powder the velocity will be less, but the projectile force will be greater, as measured by momentum, and still more so, as measured by *vis viva*, and therefore it will go further and strike harder as well.

With these revised opinions and improved ideas, "Civilian" may be able, perhaps, to see his way clear to this conclusion, although hitherto he has been opposed to it—that a heavy shot with moderate velocity, and a lighter shot with a greater velocity, may each be equally efficient in destructiveness, when to each is appointed the special task it is fitted to perform; the work of the one being a general smash of the defences, and that of the other a clean perforation through them all. This conclusion relates to differences in weight and velocity even under the same form, whether spherical or elongated. "Civilian" confounds the smashing and penetrating effects of shot, and speaks of them as though they were referable to the same conditions of the problem, and he does so because he neglects to take momentum and the cross section of projectiles into consideration. In simple penetration, there is a more special relation to the power of *vis viva*; but when materials in masses are forced bodily away, momentum is chiefly concerned in the effect, and a greater area of impact will here assist rather than interfere with the action. If this dimension for each projectile be the same, and the amount of *vis viva* be also the same, then, the conditions being alike and the causes being equal in this particular aspect, the effects in the same aspect will be alike for each; that is to say, the effects will be alike, so far as things that are proportional to the mass and the square of the velocity are concerned. For things are proportional also to the mass and the simple velocity, and in regard to these we must recognize momentum as the measure of the cause, or, rather, of the cause in this its governing aspect.

If, however, a course of experiments after a careful interpretation of them, embracing all their circumstances, should satisfactorily determine that a deeper penetration attends the superior velocity, even when all the *vis viva* quantities are equal, then the case is lost to investigation in a very obscure subject, concerning the varying powers of resistance by materials in some relation to the time of the impact—a subject about which I can say nothing at present, and of which nothing has been said by anybody, so far as I know. It is a species of physics which does not at present admit of mathematical formulæ, and, very probably, it never will. Something may be learned in the way of experiment; but the experimenter, like Professor Faraday, in his experimental investigation of gravitation, will most likely be foiled by the faint evanescent and infinitesimal character of the results, defying the power of the most delicate instruments of research. We should want something equivalent in sensibility to the spectral analysis. But about the experiments on impact just referred to, and all their attendant circumstances, "Civilian" may depend upon it that, among those circumstances, the most important will have respect to the similarity of the conditions concerning the rigidity or the yielding of the materials, whether such yielding be of an elastic or non-elastic character; for, of course, everything else being the same, the penetration will be the deepest where the material is most immoveable. A word to the wise is enough.

Yours, &c.,
BENJ. CHEVERTON.

October 19.

BOILER EXPLOSIONS.

SIR,—In connection with what has lately appeared in your columns relative to the origination of the percussive theory of boiler explosions, you will, perhaps, permit me to point out how far it has been misapprehended in the attempt to reproduce it in the article "Steam Engine," in the last edition of the *Encyclopædia Britannica*, where the "Great Eastern" explosion is explained as follows:—"The chimney, being unstayed, collapsed like a flue, under the pressure on its outer surface, and thus occasioned a sudden enlargement of volume within the heater, and a simultaneous reduction of pressure; the steam suddenly and spontaneously generated expanded against the collapsed flue, and rebounded on the casing, projecting water with it. The moving mass of water and steam, thus suddenly arrested, expended its momentum on the casing and rent it asunder."

The unstayed chimney must necessarily have collapsed like a flue, and under a moderate pressure, as was first publicly pointed out in the *Engineer* at the time of the accident. Your own columns of October 14, 1859, show how my opinion to this effect was then controverted. In the collapse, one or more seams of rivets in the chimney would be almost certain to be ruptured—a fact which none who are familiar with the condition of collapsed boiler flues can doubt. This rupture would permit the sudden escape of the free steam, thereby partially removing the pressure upon a large quantity of heated water—for from the conditions under which the heater was worked, it must have been nearly full of water at the moment before the chimney collapsed. The consequences of suddenly removing, from the surface of many tons of water already heated to perhaps 300 degs., a large portion of the pressure under which alone that temperature could be attained, would, clearly enough, be violent, although the precise condition which the liquid mass would assume in eruption has not yet been ascertained.

In the extract, however, already quoted from the *Encyclopædia*, the indispensable fact of rupture, as a consequence of collapse, is overlooked. The mere "enlargement of volume within the heater" is assumed as the cause of a "simultaneous reduction of pressure" upon the heated water. But it is doubtful whether the collapse of the chimney could have been more sudden than the disengagement of additional steam from the water, and of a pressure due to its temperature. The collapsed portion of the chimney weighed more than five tons; and in collapsing a great strain would be brought upon extensive sections of iron, even did not the chimney, upon a slight change of form, bulge out on two sides and strike the walls of the outer casing. I will not, however, press this point; but, for the sake of argument, I will assume that the collapse was inconceivably sudden, thereby "enlarging the volume within the heater" quicker than either steam, or water, or both together, could follow. This, of course, is assuming an impossibility, since the chimney could not have collapsed *sponte sua*. If steam burst forth by itself from the water, I will assume that its rate of motion was, say, 1,700 ft. per second; or if the heated water was projected *en masse*, that it would have a corresponding velocity of 85 feet per second (taking the "relative volume" of the steam, of say 56 lbs. above the atmosphere, compared with water, as 400). The water being already everywhere in contact with the inner surface of the outer casing, the blow would be delivered towards the centre. But at the instant when either steam or water, or both combined, began simultaneously to move inwards, the moving particles would be compressed against each other, like the voissoirs of an arch or the staves of a tub. If the inward movement be assumed as absolutely simultaneous from every point in the inner circumference of a truly circular casing, then, neither steam nor water could possibly reach the centre, since they would wedge fast on the way. Allowing even for a considerable irregularity of form in the casing, it is difficult to conceive of anything like a concussion of steam or water at or near the centre. In any case, it i

to be remembered that the outermost particles of water, or those already in contact with the casing, would, so far as the inward movement was concerned, remain practically stationary, and that those next within them would move but slightly. It is not to be supposed, that the heated water, in an annular casing of 7 ft. outside and 6 ft. inside diameter, could be gathered, by its own stored-up energy, into a central pillar of equal sectional area, or 3 ft. 7½ in. in diameter. Such a pillar could not be formed, and, therefore, there could be no "rebounding," as is gratuitously assumed in the *Encyclopædia*. Even were a violent rebound possible, the casing would have been burst only radially outwards, and it would not have been lifted, as it was, along with the chimney, many feet into the air and thrown over upon the deck. Under the actual circumstances of the case, no enlargement, however sudden, of the volume of the heater could, in the absence of a rupture, and, thereby, an outlet for the free steam, have produced either a diminution, or an exaltation of pressure upon the inner surfaces of the casing. In other words, the explanation, given in the *Encyclopædia*, of the "Great Eastern" explosion, and of which a correspondent in your impression of the 9th inst. speaks as "a plain and instructive illustration of my projectile theory," is physically impossible.

I am, Sir, your obedient servant,

ZERAH COLBURN.

3, Upper Bedford-place, Russell-square,
October 19, 1863.

FLYING AND FLYING MACHINES.

SIR,—I have a very curious proposition for some of your clever readers to solve. A gentleman, whom I suppose you know very well, having written a good deal in the MECHANICS' MAGAZINE about flying and flying machines—in order to enable him to make a complete model, I have given him permission to test his ingenuity and mechanical skill by letting him use a lathe and tools for the purpose of testing the thing, as I tell him it is a pity to see time wasted by useless means for proving the subject. I asked him the other day, that, supposing he accomplished his desire, what did he mean to do? he said, fly to Australia: by doing so, and flying against the rotation of the earth, he could be there in a few hours. My proposition is, Why fly at all?—because if you can keep up 24 hours without being influenced by the rotation of the earth, you will have nothing to do but when Melbourne comes round to drop into it, supposing you are in the right direction; if this was so, it would not be a matter of flying, but simply waiting. Think it over, and see what you can make of it.

Yours truly,

J. W.

[In compliance with our correspondent's request, we have thought the matter over, and this is what we make of it:—The circumference of the earth is about 24,000 miles. The atmosphere moves with the earth, fortunately for us. Any balloon, &c., suspended, as he proposes, would be exposed to a current of air moving at 1,000 miles per hour. The speed of the blast in the most violent tropical tornadoes, seldom exceeds 100 miles per hour. J. W. may imagine the effect of a current moving with ten times that velocity.—ED. M. M.]

Miscellanea.

The line-of-battle ship launch, which has been fitted by the steam factory department of Portsmouth Dockyard with a pair of small engines, driving two four-bladed screws, realized on her recent preliminary trial at the measured mile in Stokes Bay a speed of 6¼ knots, and was found to possess the same power of turning upon her own centre that has been exhibited by larger vessels in recent trials of twin-screws on the Thames. A more complete trial of the boat's capabilities will be made shortly.

The Australian papers speak of a discovery, of some importance, made on the north-west coast of that continent by Captain J. Jarman, of the "Tien-Tsin." This vessel was fitted out for an expedition up the coast in question, and was accompanied by a Mr. Padbury, of Perth. The result has been the discovery of a fertile region, with well-sheltered harbours, having a rise and fall of tide of some 16 ft., and of a valuable island, named after the discoverer, Jarman Island. Captain Jarman has, moreover, it appears, drawn up a chart of the coast from Cape Lambert to the Sherlock River, with soundings of the entire line and of the harbour of Tien-Tsin, so named after the vessel under his command. There can be no doubt that Captain Jarman's labours will form a valuable contribution to geographical and hydrographical knowledge.

A naval officer has offered the following solution for that tough geological problem, the origin of basalt. He thinks that the columns never were lava, or molten matter of any sort. Wherever naturally ball-and-socket jointed columns are exposed to view in cliffs, or in separate groups, or mounds, in plains far away from volcanic districts, there the bamboos, from which the columns derive their form and features, really did grow. The fact of coal, fossil wood, and pillars of basalt being so often found in contact, one above another, or side by side, arises from the simple fact of their having all once been growing vegetable matter. Instead of basaltic columns being protruded upwards through the coal beds, the bamboos which formed those columns grew before the surrounding horizontal or overlying strata of coal or other matter were formed.

Spain is not behind the rest of the countries in Europe in war expenditure this year. The army and navy expenses for 1863 show an augmentation already of eighty millions of reals, originating, doubtless, in some measure from the expedition to St. Domingo.

It appears by a communication from Ajaccio that the cultivation of cotton has been successfully introduced into the island of Corsica by Count Bacciochi. The Count generously placed one of his farms in the neighbourhood of Ajaccio at the disposal of a manufacturer, who offered to make a trial of the cultivation of cotton. The experiment succeeded so well that it has been extended to several other parts of the island, and the result has exceeded the expectations of the planters. Samples of the cotton cultivated in the island of Corsica have been sent to Paris for exhibition.

Messrs. Scott and Co., of Cartsdyke, launched a beautiful steamship last week, the second of eight being built by the same firm, for the French Transatlantic Steam Navigation Company, which was gracefully named "Lafayette," by the wife of C. H. Dunlop, Esq. The "Lafayette" is 3,400 tons, builders' measurement, and of the following dimensions:—Length, 350 ft.; breadth, 45 ft.; depth, 33 ft. She has four decks, the upper being flush from stem to stern, and the three lower having each a height of 7 ft. 3 in. She will have accommodation for 300 first-class passengers, hold capacity for 1,000 tons of goods, and will be able to stow 1,500 tons of coal in the bunkers. Her machinery will be furnished by the Greenock Foundry Company, and will consist of a pair of side lever engines of 850-horse power nominal, with levers of malleable iron. The cylinders are 95 in. in diameter, with 9 ft. 6 in. stroke. The boilers, four in number, are tubular, each of the weight of 61 tons, and each sole plate weighs 55 tons. The paddle wheels will be 37¼ ft. diameter. The "Lafayette" is the largest steamship ever built in Greenock; is sister to the "Washington," launched by the same firm on 17th June last. The third ship will be ready about the end of December. The five other ships are being built in yards erected by the Messrs. Scott in St. Nazaire, in France.

It is stated from Frankfort that a patent has been taken in England and in most of the Continental States for a peeling and cleansing machine of all kinds of pulse, by which a great saving of time and an increase of the produce of flour will be secured. The proprietors of the largest flour-mills in Switzerland state that the old problem of peeling pulse is now solved, and that they are fully satisfied with the new machine. The bran has proved to be available for paper fabrication.

A model of a proposed plan for the storage of petroleum in the original casks, without leakage, and as a consequence removing the liability to smell, was shown on Friday, at the office of Messrs. Holt and Banner, Sweeting-street, Liverpool. Without going into details we may mention that the leading features of the plan are the sinking of the original barrels in cisterns or tanks of water, so that they may always be submerged. The barrels are introduced into the wells by a shaft wit[illegible] greatest facility, and when required can [illegible] recovered. The wood barrels being ke[illegible] the water would, it is contended, swell them so as to render leakage impossible. The wells or tanks could be constructed of brick, or in any other way, so that they are capable of containing a sufficient quantity of water. So far as can be judged by the model, the plan appears to possess considerable merit, and is worthy of attention now that the question of doing away with the smell from petroleum is brought so prominently under public notice.

On Monday, Her Majesty's ship "Tweed," laden with the last consignment of the telegraphic cable about to be laid down over a length of 1,200 miles, from the mouth of the Persian Gulf along the sea coast to Mekra, left the works of Messrs. Henley and Co., the contractors and manufacturers, at North Woolwich. The cable, which has been constructed for the India Office, under the superintendence of Lieutenant-Colonel Stewart, of the Royal Engineers and India Office, Public Works Department, in conjunction with Sir C. Bright and Mr. Latimer Clark, the engineers and electricians, has been twelve months in process of manufacture, and is understood to be the most complete cable as yet produced in this country. The core consists of 225 lbs. of copper wire and 275 lbs. of gutta percha per nautical mile, covered with tape, and has been prepared by the contractors, in lengths of about 3 nautical miles, at the works of the Gutta Percha Company, in the City-road. Everything has been prepared in the way of insulation, jointing, covering, and serving by the most experienced workmen. The core is covered with Russian hemp and Stockholm tar. The iron covering for the main cable consists of 12 (No. 7 gauge) galvanized iron wires, and the iron covering for the shore end of the cable consists of 12 (No. 2 gauge) galvanized iron wires. As regards the external coating of the cable, it has been covered, after the iron wires were laid on, with two coatings of mineral pitch and Stockholm tar, and then alternately with tarred hemp and yarn, and all covered with Chatterton's compound. The entire cable, which has been manufactured at the rate of 50 nautical miles per week, has been thoroughly tested by the engineer, who, with Colonel Stewart, are to follow overland at the end of the month to commence the laying down and submersion of the line. The cargo of cable by the "Tweed" makes the fifth shipment within the last three months.

The Tyne and Clyde shipbuilders are likely to meet with a spirited opposition before long in iron shipbuilding from the Welsh ports. The Newport Wood and Iron Shipbuilding Company have purchased an extensive private shipbuilding yard at Newport, and arrangements are in progress with the view of building iron ships. The negotiations which have been going on for some time between the trustees of the Marquis of Bute and Mr. Scott Russell, have also terminated successfully, and the latter gentleman has entered into arrangements to establish an iron shipbuilding dry dock near the mouth of the Taff, at Cardiff. No time is to be lost in constructing the dock, as Mr. Scott Russell has accepted contracts for building three iron ships, and the same are to be completed within a specified period. From the proximity of both Newport and Cardiff to the coal and iron districts of South Wales, and the consequent cheapness of iron and fuel, it is believed that iron shipbuilding can be carried on so as to be able to successfully compete with the Tyne and Clyde shipbuilders.

Captain Ericsson has contracted to construct some 13 in. smooth-bore guns which are to have a much greater initial velocity than any now in use. He is to receive nothing for these guns unless they burn over 50 lbs. of powder—for every pound of powder beyond 50, Mr. Ericsson is to receive 5,000 dols. He is confident of being able to burn 100 lbs., and is certain of burning 75 lbs. The solid shot will weigh 220 lbs.

In Providence, R.I., there are 1,535 persons employed on Government work. One establishment alone employs 500 workmen on the Springfield rifled musket, and other factories are working with smaller forces on particular parts of the same favourite arm. An iron foundry employing 100 hands is now casting ordnance comprising 11 in. and 13 in. Dahlgren guns, with shot and shell for the same. A gun is turned off once in four days, and five tons of shot and shell are cast per day. The wrought-iron Ericsson [illegible] for the monster iron-clad "Dictator," [illegible] at New York, is to be bored an[illegible] ion at this place. After [illegible] ht to New York and it is be[illegible] ntendence of Captain [illegible] 6 in. in thickness.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

671. J. Tomlinson. *Improvements in machinery for opening twisted yarns and woven fabrics.* Dated March 11, 1863.

This invention consists in the application of two or more feeding apparatus to the main cylinder of the ordinary hard waste breaking and finishing machine, each feeding apparatus being fitted with two feeding rollers, or with one feeding roller and a concave trough. Each feeding apparatus can be adjusted so as to be brought closer to or further from the teeth of the main cylinder. The gearing for driving all the feeding apparatus is connected to a reversing motion, so as to be able to back out the feed of each feeder at the same time. *Patent completed.*

672. J. Renshaw. *Improvements in machinery for dressing, raising, and brushing silk and cotton velvets, velveteens, cords, plushes, and other piled fabrics.* Dated March 11, 1863.

This invention consists in causing the fabric to be operated upon to pass over and under two series of rollers, above which are mounted a series of circular brushes, to which a rapid revolving and a to-and-fro motion in the direction of their axes is given. *Patent completed.*

673. W. Rosseter. *Improvements in back-beam warping machines.* Dated March 11, 1863.

This invention consists in certain improved combinations and arrangements of self-acting machinery for stopping back-beam warping machines when a warp thread breaks or fails to be supplied, and also combining the dents and cross bars with spiral springs for expanding and contracting the reed or wraith to suit the warp, and in the mode of communicating motion to such machines. The invention cannot be described without reference to the drawings. *Patent completed.*

674. F. B. Kraushaar. *Improvements in apparatus for winding, cleaning, measuring, sorting, doubling, throwing, and reeling silk, parts of which improvements are also applicable to like machinery for spinning, doubling, and twisting cotton, wool, and other fibrous materials.* Dated March 12, 1863.

This invention relates to improvements upon and applicable to certain machinery and apparatus patented by Rudolph Bodmer as a communication from the present patentee, dated the 29th September, 1857 (No. 2508). These improvements consist—1, in certain mechanism for regulating the tension of filaments or threads of silk, cotton, or other fibrous material when the same are wound upon or off reels, bobbins, spindles, spools, and such-like objects in the various operations of winding, twisting, and doubling, and for which and other operations a uniform tension of the thread is requisite or desirable. This tension regulator consists of a bar rod or lever, one end of which is furnished with a suitable eye, hook, or other guide, through which the thread passes, and by means of which it is supported by the thread the tension of which is to be regulated, whilst the other end of the bar is joined to and forms part of a simple friction apparatus connected with the spindle, bobbin, or other object from which the thread is wound off, or with the spindle upon which it is wound, or with both. The regulator resting with one end upon the thread will by its weight depress it according to the amount of resistance to be overcome in unwinding it from its spindle, and cause it to deviate more or less from the direct line. If, therefore, an increase or a decrease in the resistance takes place, the deviation will become smaller or larger, and the regulator will rise or fall, and thereby decrease or increase the friction upon the spindles in connection with it. In this manner a constantly uniform tension of the thread will be maintained. In case of the strain becoming too great, the winding-on spindle will, by the same friction apparatus, be thrown out of gear with its driving disc or strap, whereby the breaking of the thread is prevented. 2, The improvements consist in self-acting or automatical weighing by sorting machinery or apparatus, intended chiefly for weighing and sorting bobbins or tubes of silk thread of equal lengths. *Patent completed.*

675. H. D. and J. W. Taylor. *Improvements in finishing woollen, worsted, and other fabrics, and in machinery or apparatus to be used therein.* Dated March 12, 1863.

This improved process or finishing operation consists in causing the surface or surfaces of fabrics requiring to be dressed to pass in contact slowly over, under, or between a flat, convex, cylindrical, or other dresser or dressers, while the latter are in rapid motion, so that the surface of the fabric is thereby subjected to a peculiar operation, the effect of which is to raise the pile or staple in the first instance, and then to reduce it by rubbing till the required finish is obtained, and finally to beat or cleanse the fabric from the pumex dust and other impurities. The object of this invention is to produce such a finish upon the surface of the fabric as shall render it immaterial in what way the same shall be cut and put together in the manufacture of any article therefrom. The pile or nap of the woollen, worsted, or other goods, instead of being raised and dressed in the usual way so as to lay in an inclined direction on the surface of the piece, is raised and reduced so as to form a short and even nap, standing vertically on the surface of the fabric. The machinery or apparatus which constitutes the second part of the invention, and by means of which it is proposed to effect the aforesaid finishing, consists of a dresser or dressers having pile-raising plates, rubbers, and beaters or cleansers, actuated by any mechanism suitable for the purpose, and the whole mounted in a proper frame fitted with feed and take-off rollers, by which the fabric is propelled. *Patent completed.*

676. L. Dessens. *An improved bath or bathing machine adapted for deep water.* Dated March 12, 1863.

This invention consists of two iron or wood frames fastened to each other by vertical uprights. The bottom and sides are supplied with nets of canvas or pieces of cloth, metallic grates, or wire gauze, in order to allow the water to enter into the bath. When the bather is seated in the bath, his whole body is immersed in the water in the ordinary bathing posture. The bath is prevented from sinking by means either of an india-rubber girdle inflated with air or by the application of cork or other suitable buoyant substance. The bather by turning a crank imparts a rotary motion to a screw placed at the head of the bath, and by pressing with his feet on paddles or treadles placed at the ends of a cross-bar fixed to a case, he is enabled to impart to the screw circular and horizontal motion, and thus direct the bath either to the left or to the right, or in a straight line, serving also the purpose of a rudder, according to the direction desired to be taken by the bather. *Patent abandoned.*

677. W. Clark. *Improvements in breech-loading fire-arms.* (A communication.) Dated March 12, 1863.

This invention is not described apart from the drawings. *Patent completed.*

678. E. H. Lomas. *Improvements in the action of charger or measure for powder-flasks, canisters, or other vessels.* Dated March 12, 1863.

This invention consists in the following arrangements:—Within the charger or measure, and near where it connects with, or is attached to the flask or other vessel, and at such distance from the outer end as will give the capacity or measure required, are arranged two discs of brass, or other suitable metal, the one fixed and the other moveable, both discs having openings so shaped that the spaces between the openings in the moveable disc will cover and close the openings in the fixed disc. But when the moveable disc, which turns upon a central pin or axle, shall have been turned round until the openings of both discs, which are made to correspond in shape, come together, then a communication will be opened between the flask or other vessel and the charger, which will allow the gunpowder or other substance to be measured or discharged to flow into the charger. And, when the charger is filled, the moveable disc will be brought back to its place by the means of a hoop spring of brass or other like suitable material. The turning of the moveable disc, so as to open the communication, is accomplished by acting with the thumb or finger on the end of the said spring, which is attached to the moveable disc by a pin or bar which works through a slot in the side of the charger, the slot being of sufficient length to allow the apertures in the discs to come opposite to each other by the moving of the moveable disc upon its central pin or axle. *Patent completed.*

679. J. Polkinghorne. *Improvements in treating tin ores, and in apparatus for treating ores and matters containing arsenic.* Dated March 12, 1863.

This invention consists—1, in treating tin ores as hereafter described. The patentee treats tin ores with rectified concentrated or diluted sulphuric acid and chloride of sodium, and keeps them in a heated state till the whole or nearly the whole of the iron, copper, and foreign matters and impurities are dissolved, or so reduced that they may be easily separated by washing. Four hours will generally be sufficient, but more or less time may be allowed. The progress of the operation may be ascertained from time to time by withdrawing a small portion from the furnace or pan and washing it in water, and then smelting the ore. When the ore has been sufficiently acted upon, it is removed from the furnace or pan to be washed in water to separate from it the soluble and insoluble matters and impurities it may contain. The invention consists—2, in an improved method of smelting tin ores. In order to free the metal contained in the ores, he mixes 20 parts by weight of the ores, containing about from 60 to 72 per cent. of metal, with a flux composed of about from 3 to 5 parts by weight of culm, and from about 1-16th to ¾ of a part by weight of wrought iron, wrought-iron borings or turnings, or tin-plate clippings, and from about 1-16th of a part to 2 parts by weight of caustic soda, bicarbonate of soda, pearl-ash, or potash. According to the nature of the tin ores, the exact proportions must be fixed by a competent smelter, whose experience will readily enable him to apportion the proper doses, according to the ores operated on. The patentee smelts the mixture of ore and flux in an ordinary smelting or reverberatory furnace, in like manner to that usually pursued for the purpose of reducing tin ores. The invention consists—3, of an apparatus for treating ores and other matters containing arsenic, in order to obtain arsenic therefrom. The apparatus for obtaining arsenic from ores, and other matters containing the same, consists of a furnace surrounded by flues, with an outlet leading from the furnace into a chamber for collecting the gases. The ores or matters are fed into the retort through doors made for the purpose, or through shoots leading into and through the roof or upper part of the retort; a pipe is carried through and into the upper part of the retort, through which the arsenious gases are led into the usual poison chambers or flues. *Patent completed.*

680. H. B. Barlow. *Certain improvements in looms for weaving.* Dated March 13, 1863.

The nature of this invention consists in supporting the bobbins containing the warp yarns or threads by a plate connected to or forming part of the loom, and in guiding the said warp threads direct to the loom, whereby facility is afforded in piecing up a broken end, and also in sizing and dressing the warp before it passes through the healds, and in an improved arrangement of parts for giving off or delivering the warps, and for taking up the woven fabric. *Patent completed.*

681. J. Harris, J. Butler, and J. H. Fraser. *Improvements in machinery for rolling armour plates, bridge plates, boat plates, and other plates and bars of iron.* Dated March 13, 1863.

These improvements consist in constructing and arranging rolls in the manner hereinafter explained, whereby lateral pressure is applied to plates and bars of iron during the rolling process, and the plates or bars are fed to or conducted from the rolls in a simple and expeditious manner. Plates and bars of iron rolled by this improved machinery are of uniform or nearly uniform density throughout. The patentees make the upper roll of the pair of rolls somewhat shorter than the lower roll, so that the lower roll projects at either end beyond the ends of the upper roll. A recess is made in each of the standards carrying the rolls, the said recesses being at about the level of the acting surfaces of the rolls. In each of the said recesses a rotating circular collar is placed, the said collars rotating on vertical axes. The lower face of each rotating collar rests on the cylindrical surface of the lower roll, and the cylindrical surfaces of the rotating collars bear against the ends of the upper roll. When a plate of iron is passed through the rolls, the edge of the plate is prevented from spreading laterally by the rotating collars; and the edges of the plate are subjected to the same pressure, or nearly the same pressure, as the other parts of the plate, and great uniformity and excellence of quality is obtained in the rolled plate. The upper roll can be raised or lowered without interfering with the rotating collars and lower roll. To roll plates or bars of any required width, it is only necessary to employ an upper roll having a length equal to the width of the plates to be rolled, the rotating collars being adjusted so as to bear against the ends of the upper roll. The lower roll being always longer than the upper roll, does not require to be changed on changing the upper roll. The rotating collars are adjusted by means of screws acting on their bearings in the recesses in the standards. They guide the plate or bar to and from the rolls by means of rotary guide rolls provided with flanges sliding thereon, so as to accommodate plates or bars of different widths. The invention is applicable to the rolling of armour plates, bridge plates, boat plates, and other plates and bars of iron. *Patent completed.*

682. C. T. and A. Lutwyche. *Improvements in metallic pens.* Dated March 13, 1863.

This invention consists in making metallic pens from the alloy called aluminium bronze, which alloy is composed of copper and aluminium in the proportion of about 92½ parts by weight of copper to about 7½ parts by weight of aluminium. Metallic pens may be manufactured from the said alloy by the machinery commonly employed for the manufacture of steel pens. Pens made of aluminium bronze may either have iridium osmium points, such as are ordinarily used for gold pens, or the points may be of the same material as the body of the pen. Pens made of aluminium bronze have the appearance of gold pens, and are not corroded by writing ink. *Patent completed.*

683. J. Taylor. *Improvements in fire bars and bearers.* Dated March 13, 1863.

These improvements in fire bars consist—1, in constructing fire bars with a number of taper holes or openings, which holes or openings are made horizontally through the strengthening rib or belly of the bar. By reason of the holes or openings being made taper, a much greater supply of atmospheric air is obtained, which assists the combustion of the gaseous products of the fuel. 2, In the top or surface of the bars is a wide groove running longitudinally the whole length thereof; these grooves becoming filled with the fine ashes protect the bars from the heat of the fire, and also prevent the adhesion of clinker, thus adding greatly to the durability of the said bars. 3, The inventor constructs fire bars with the taper holes or openings, as hereinbefore described; but instead of the longitudinal groove in the surface thereof, he constructs them with a number of projections cast across and on the surface of each bar, forming alternate projections and spaces. These spaces answer and are for a similar purpose to the longitudinal groove described in the bar above. The bearers or cross rails which support the fire bars are perforated with a number of taper holes or openings for facilitating the admission of atmospheric air to the bars and fire. *Patent abandoned.*

684. J. B. M. A. Bourreiff. *Improvements in transferring, by the means of typography, colours and metals on surfaces in general.* Dated March 13, 1863.

In performing this invention, the inventor takes paper, sized, unsized, or half-sized, and pays it over with one or more coats of such preparation as that next hereafter described, or its equivalent:—Gum arabic dissolved in water, tapioca, sago, starch, or other fecula mixed in hot water, or boiled in water, and the whole well mixed and stirred. The preparation may be varied so long as similar sticking, adhering, and agglutinant properties are preserved. After the coating it is better to "satin" the paper. The satining aids the transfer of the typographic impression to be made on the coating—the coating completely separates the design from the paper as hereafter stated. The typographic impression is taken in the ordinary manner, but in lieu of ordinary printing ink he uses a mordant or strong varnish, in which it is better, with the view of obtaining more intense colour, where colour enters into the design, to incorporate or mix a quantity of the desired colour with the mordant or varnish. The form or block is covered or "inked" by a roller with the mordant or varnish, and a print, on the coated paper, is taken directly after the printing; or before the ink becomes dry, he powders it over with the same colour as that in the mordant by means of a puff, soft brush, hare's foot, or other like article. This operation should be performed at every change of colour. When all the colouring matter for the print is dry, he cleanses it by a feather, brush, or other like soft article drawn over it. When the paper has received all the colours, and the gold entering into the design, it is as well—though not absolutely necessary—to pass the paper through rolls, to give a glaze, and to impart homogeneity to the colours and the gold. To transfer the impression to the surface for receiving it, he applies an hour or more before using the impression, both to it and to the surface to which it is to be transferred, a liquid, composed of essence of turpentine, Venetian turpentine and colophony, in the proportion of 5 parts of turpentine, 1 part of Venetian turpentine, and ½ part of colophony. He then applies the print to the surface, and uses a roller or rubs with the palm of the hand or otherwise to ensure contact of every part of the impression. He afterwards wets or moistens the paper and separates or draws off the paper from the impression, when the design alone will adhere to the surface to which it has been transferred. For articles subjected to firing after the transfer of the design to them, the colours used must be mineral, and not vegetable, and should be such as are employed by painters on porcelain, china, and glass. Instead of paper for carrying the design, he sometimes uses a textile fabric. *Patent completed.*

685. W. H. STUBBE. *Improvements in governors for marine and other engines.* Dated March 13, 1863.

This invention consists in a peculiar construction of hanging shaft carrying the governor balls, and driven from above, and also in fitting such hanging governor in gimbals, or a universal joint, so that it may always hang vertical, notwithstanding the motion of the ship or vessel, the gearing that rotates the governor always remaining properly in contact, and hence the governor is rendered as efficient in regulating the speed of a marine engine as of a stationary engine. *Patent abandoned.*

686. A. WYDLER and C. THORNTON. *Improvements in printing and dyeing woollen fabrics.* Dated March 13, 1863.

This invention consists—1, in the use of a new substance as applied to the printing of woollen fabrics. For this purpose the inventors use the substance known as deoxidized indigo, in combination with gum or other thickening matter. 2, In producing colours upon woollen goods, the patentees, in the first place, print them with the said deoxidized indigo, or other printing material, and then dye them to any desired colour. *Patent abandoned.*

687. J. H. JOHNSON. *Improvements in fastenings suitable for portions of harness and other purposes.* (A communication.) Dated March 13, 1863.

This improved fastening is constructed as follows:—As applied to the hames of a horse collar, one of the branches is provided with two holes made at right angles to each other, and formed one above the other, so that the two will partially intersect each other. Into the lower hole is fitted a bolt or pin, having a transverse notch cut in it at the part where it crosses the upper hole. This bolt or pin is connected with a ring or metal eye through which the martingale is passed, the connection with the bolt or pin being such as will cause the bolt or pin to turn partially round its socket or hole on turning the ring or metal eye to one side. On the opposite arm of the hame there is formed a spindle or stud which fits accurately the upper hole above referred to, and a transverse notch is also formed in the under side of this stud corresponding to the before mentioned notch in the bolt or pin. In order to unite or secure the hames, the bolt or pin must be first twined partially round, so as to bring its notch in a line with the upper hole, when the stud can be readily inserted. The bolt or pin is now returned to its original position by bringing the ring or metal eye down again into a vertical position, whereupon the said portion of the bolt or pin will enter the notch in the stud or spindle, and lock it effectually in its place. The pressure of the martingale in the ring or metal eye prevents it from being turned sufficiently to release the hames, consequently the accidental opening of the hames is avoided. In order to release them from the collar, the martingale must be first disconnected, when the ring is free to turn the required extent for the opening of the fastening. *Patent completed.*

688. W. SMITH. *Improvements in machinery for cultivating land and setting seed.* Dated March 13, 1863.

For the purposes of this invention, the framing of the fore carriage is, by preference, of a triangular form, and is connected at its hinder end with an axle on which there are two wheels, which the patentee calls the main wheels, one at each end of such axle. There is also, at the front end of the fore carriage, a locking axle with two wheels, which have, in addition to their broad tyres, central projecting rims, which cut into the band when the machine is in use. The steering is by means of a lever handle on an upright shaft, by which the fore wheels and their axle are moved. At the front end of the triangular or fore frame is applied a draft instrument or apparatus, such as was described in the specification of a former patent granted to the present patentee, dated 11th January, 1856 (No. 87), in order that the end of the draft rope, which comes into action at a headland, may cause the implement to be turned by the power employed for drawing it from headland to headland. The cultivating tines, pressers, and seed tubes are arranged in a similar manner to that described in the specification of a previous patent granted to the present patentee, and dated the 13th May, 1861 (No. 1219). These tines, pressers, and seed tubes are mounted in a lever frame, the forward end of which is pin jointed to projections fixed on the axle of the main wheels of the implement. The front or triangular frame is connected to the axle of the main wheels, and the two outer parts or sides of the fore framing extend back, and have handles applied thereto, by which the fore wheels and front end of the fore carriage can be lifted. In front of the axis of the main wheels a seed box or chest is placed on the fore framing or implement, which, by trunks or passages, is connected to a smaller seed box placed on the outer parts of the fore framing, which are extended back, and which are bent upwards in order to carry such hinder seed box. On the axle of the main wheels is fixed a chain wheel, and on the shaft or axle of the hinder seed box is also fixed a chain wheel. Thus the chain wheel on the main axle, by an endless chain, gives motion to the axle in the hinder seed box. From the shaft or axle of the hinder seed box motion is communicated when desired to an axle or shaft, which, by drums or pulleys, gives motion to endless bands in the trunks or passages, by which the seed is raised from one seed box or chest to the other, as is well understood. From the under part of the hinder seed box pipes or flexible tubes descend to the drills, as is usual. The lever frame which carries the tines and drills is capable of being raised, and the raising may be done by any convenient apparatus. That which is preferred is a barrel put in motion by a crank handle and bevel gearing, mounted on the end of the bars which support the hinder seed box. The hinder lever frame which carries the tines has two wheels, which run on the land and regulate the depth to which the tines descend into the land, and provision is made for adjusting the tines in the lever frame or for adjusting the axles of the wheels. *Patent completed.*

689. W. E. GEDGE. *An improved plough.* (A communication.) Dated March 14, 1863.

This plough is composed of a beam or body similar, by its share, coulter, mould-board, handle, and oblique axle, to the ploughs usually used in vineyards, but differing from them in the tie piece, and a vertical shaft turning in sockets, one of which is on the heel. The upper part of this shaft receives the moveable handle, and the shaft further carries the small plough beam, which is composed of a concave mould-board, a coulter, and a share. If the ploughman acts upon the moveable handle, the small plough beam will describe a greater or lesser angle; and if, on the contrary, he brings it against the fixed handle, the small beam will come into line, and be lodged between the mould-board of the main beam and its fore part. The obliquity of this movement is regulated by a double segment of a circle placed on the tie piece and pierced with holes, into which passes an iron pin for arresting the moveable handle. This plough, by means of a moveable frame fitting on the axle, lends itself to every description of ploughing, in lines or furrows, whether one horse be on the left of a row of vines or other plants, and the other horse on the right, or whether both be on the same side. And this plough, by changing the form of the instruments, will work between two rows of all plants cultivated in ridges or lines. *Patent abandoned.*

690. F. RUDRUM. *An improved apparatus for registering.* Dated March 14, 1863.

This apparatus consists of a box or case, one side of which the inventor terms the cashier's side, and the other the indicator side or front; the said box or case contains the registering mechanism, which will be covered up, but on the cashier's side there will be glass, through which the indicating or registering figures will be visible. The mechanism consists of spring stops and stop pieces, or mechanism acting on shafts or axles with wheels set thereon, and for use in establishments having a number of assistants, requiring to register receipts of cash. The apparatus will be divided so that some wheels and mechanism will be appropriated to indicating each of the assistants whose receipts are to be registered, others the amount of cash received form each such assistants, and others the total amounts received from all the assistants up to a given amount. *Patent abandoned.*

691. W. WEST. *Improvements in valves.* Dated March 14, 1863.

The chief advantages obtained by these improvements in valves are facility in adaptation to degrees of pressure, facility of renewal, simplicity of construction and form, easy and equal action, easy adaptability to any position, and cheapness, as a result of simplicity. The principal features of the new valve are a valve seating, which would commonly present a form simply conical, and an india rubber or other elastic band or cord, which the patentee proposes to coil spirally about the external surface of the said seating within a groove formed for its reception. The bottom of this groove is perforated more or less frequently and extensively for the emission of water, steam, fluids, air, or gases. *Patent completed.*

692. J. PAGE. *Improvements in taps or valves.* Dated March 14, 1863.

This invention is not described apart from the drawings. *Patent completed.*

693. J. W. M. CARTER. *Improvements in machinery for sawing or cutting wood.* Dated March 14, 1863.

This invention is not described apart from the drawings. *Patent completed.*

694. W. TANGYE. *Improvements in portable hydraulic punching machines.* Dated March 14, 1863.

This invention is carried out as follows:—The cylinder in which the cam works is situated vertically, and is open at the bottom. The cylinder is connected with the rest or support which carries the fixed punching tool, by means of a strong bracket of a nearly semicircular form. The upper or moveable punching tool is fixed to the bottom of the ram, and projects from the open bottom of the cylinder. The pump is situated vertically or horizontally at the top of the cylinder, and is fixed in the reservoir containing the water or other liquid with which the machine is worked. The said reservoir is supported at the upper part of the cylinder. The descent of the ram and moveable punching tool is effected by working the handle of the pump. The ascent is effected in the following manner:—The pump is so constructed that, by moving its handle beyond the point to which it is required to be moved in working the pump, the valves of the pump are opened and the liquid may pass from the cylinder through the pump to the reservoir. In order to lift the ram, a lever is made to turn on an axis on the side of the cylinder. A cam on the said axis engages in a recess in the side or the ram, or with a shoulder on the said ram, and by depressing the lever the said cam raises the ram. The form of the cam is such that it does not impede the descent of the ram. *Patent completed.*

695. R. ALEXANDER. *Improvements in mariners' compasses, and the parts in connection therewith, and in the application thereof to magnetic instruments.* Dated March 14, 1863.

This invention consists in compensating or adjusting media, or both in combination, to render the magnetic needle independent of the local attraction of iron or other metals, metallic ores, or compounds, in the ship, vessel, or other place where the compass or needle is fixed or used. The means by which the patentee proposes to effect the said improvements, are:—1, By appliances of counter-acting and adjusting magnets or magnetic poles upon the compass needle card or cards, or otherwise placed, as may be found most effective in practice; 2, by the use, if necessary, of a moveable magnetic ring or rings, attached to the needle card by springs or otherwise, so as to be easily removed when it is required; 3, by the use of a series or number of magnets placed on or in a flat or curved surface, with or without rims or bands of soft iron, stationary or revolving, above, below, or horizontal with the middle card or cards, or both above and below them; 4, by the application of electricity or galvanism in conjunction with a part or the whole of the aforesaid appliances; 5, by the use of one or more of the magnetic needle cards, and one or more of the appliances of those explained above, placed one above the other, revolving in union or independent of one another on the same (or one distinct) pivots, or one or more of them stationary and another or others revolving, or any one or more of these used in conjunction with a simple magnetic compass card, as commonly used, only revolving in distinct pivots whilst a part may be stationary; 6, by the use of aluminium metal for the needle cards, or india rubber composition commonly called ebonite for the cards, rims, bowls, hoods, boxes, binnacles, and gimbals, and other parts of the compasses and appliances, or an admixture of steel filings or cuttings in the india rubber composition for some of these, or the whole of the said parts above referred to; 7, by the use of hollow iron spheres or spheroids to encompass a part or the whole of the apparatus; 8, by the application of a spring pivot or point on which the magnetic compass card revolves, and springs to an outward or second gimbal to the bowl; 9, by the application of the said invention to electro-magnetic instruments. *Patent completed.*

696. J. C. RICHARDSON. *Improvements in the construction of ships.* Dated March 14, 1863.

It is, according to this invention, proposed to construct the frames or ribs of double-angle or T-iron, having the flanges on the outside, with holes punched for the reception of fastenings. Such iron frames may be galvanized or coated with paint, or other material, or otherwise protected from oxidation or not, as required. The space between these frames is filled in with short lengths of wood plank, the same thickness as the moulded size of the iron frames, and dressed fair with the iron outside and in, or made thicker so as to project inwards beyond the inner edge of the iron frames, and to butt against each other, and secured by means of iron or other rivets to the flanges of the iron frames, or in any other manner. If in the construction of the ship wood be partially used for floors or transoms, or fashion or other timbers instead of T or angle iron, or in combination with it, so as to render the filling-in pieces of wood partly unnecessary, then such filling-in pieces to be only partly used. The keel, stern, and stern-post are to be of wood. The outer planking, which is to be of wood, is secured by wooden trenails or metal bolts, or other suitable fastenings, which may be rivetted or otherwise secured on the inner work. An inner planking may be added of wood, and all or part of the fastenings may be driven through it from the outer planking. *Patent abandoned.*

697. W. YOUNG. *Improvements in type composing and distributing machines.* Dated March 14, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

698. R. MORELAND, jun. *Improvements in apparatus for making extracts of hops and for selecting or separating the seeds and pollen from hops.* Dated March 14, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

699. J. WALWORTH. *Improvements in machinery or apparatus for washing or cleansing and drying Egyptian wheat, beans, and other kinds of grains or seeds.* Dated March 14, 1863.

The first part of this invention consists of a cylindrical vessel, having a central rotary spindle therein, on which are a series of projecting arms. This cylinder and spindle are by preference placed vertically. There is also another cylinder, with a central rotary spindle, having an archimedian screw thereon, which cylinder is, by preference, placed at an inclination to the former cylinder, and a channel or recess is formed longitudinally on the upper side of this inclined cylinder. The two cylinders are connected

by a spout or pipe at their bottom ends. A hopper is placed above the vertical cylinder, from which the grain to be washed is supplied or fed thereto, and an outlet spout is provided at the top end of the inclined cylinder for the grain to pass out. Also a pipe and tap are introduced at the top of the cylinder for the supply of water. Both cylinders are kept full and overflowing at or near the top of the vertical one, and an outlet pipe and tap are provided at the bottom for the escape of water and dirt. Motion is given to both the spindles by suitable gearing or pulleys, and straps or cords, so as to produce agitation of the grain in the vertical cylinder, and cause the archimedian screw to raise the grain up the inclined cylinder, from which it escapes at the top by the spout. An outlet is also provided at the top of the vertical cylinder for chaff or light dirt to float off, and there is also a perforated false bottom placed in the inclined cylinder to prevent the grain from passing out by the dirt pipe. The second part of this invention consists of a vertical hollow spindle capable of rotating, having a series of hollow circular tables attached thereto, and communicating therewith. A series of scrapers are placed in contact with the upper surface of each table, at tangents thereto. Steam is supplied to the hollow spindle at the top, and condensed water is let out at the bottom. Grain, after being washed, as set forth in the first part, is conducted by a hopper or dish to the centre of the uppermost table, and is gradually pushed outward by the scrapers off the edge as the spindle and table rotate, whence it falls into another dish or upper table, which conducts it to the centre of the second table, where it is again driven gradually outward by the scrapers to and off the edge to the next table, and so on from one table to another, when it finally passes out at the bottom, dried. *Patent completed.*

700. W. Boaler. *Improvements in the preparation of colouring matters for dyeing and printing.* (A communication.) Dated March 14, 1863.

This invention consists in the use of gases, such as those arising from the decomposition of metals or other substances by means of acids. The gases so produced are employed for acting upon aniline and its homologues, in order to produce oxidation, or partial oxidation, for the purpose of producing from aniline colouring matters which may be used for industrial purposes. *Patent abandoned.*

701. E. Oliver and G. Myers. *Improvements in apparatus for lowering and disengaging boats from vessels.* Dated March 16, 1863.

This invention consists of an apparatus by which a boat can be lowered into the water upon an even keel, and both ends simultaneously freed from the tackle, and is as follows:—Over the boat is a tube having a rod or bar in the inside furnished with a right-handed screw at one end, and a left-handed screw at the other. Over the screwed portions nuts are made to travel as hereafter explained. The tube is fitted at each end with a pulley block and a weighted hook; to the weighted hook the boat is suspended, the points of the hooks being held by the nuts to prevent the boat leaving them until disengaged. The ropes pass round the pulley blocks on the ends of the davits, and from thence to barrels fitted to suitable framing firmly bolted to the deck of the ship. The barrels are geared, and their rotation is governed by means of a break under the control of a man in the boat. The rod or bar has at one end a small hand-wheel, by which it is turned. *Patent abandoned.*

702. F. Hayes. *An improved stove or fire-grate, for heating, cooking, boiling, or other similar purposes.* Dated March 16, 1863.

This invention is not described apart from the drawings. *Patent completed.*

703. T. W. Willett. *Improvements in means for reefing and furling square sails of ships and vessels from the deck thereof.* Dated March 16, 1863.

The sail is, according to this invention, bent to a wooden roller, secured on the fore part of the yard by suitable bearings at each end, and supported in the centre by a roller claw firmly secured to the mast, and of sufficient size to receive the entire sail when wound up on the roller spar. A solid or hollow metal rod of equal length to the roller spar is secured by turns in suitable bearings fixed near the ends of the yard, and forming part of or closely connected with those in which the roller spar turns. Each end of the metal roller is furnished with a cog-wheel, which gears with a similar wheel on the ends of the roller spar. On the centre of the metal roller is a chain wheel, grooved similar to the chain wheel of a clock, for the purpose of forming a secure hold for a chain, which, after passing over it, is led through two sheaves fixed in the mast, one a short distance above the other, but both higher up in the mast than the yard would be if the sail was set. The chain is of sufficient length to permit of the furling and unfurling of the sail, and the two ends are attached to two haliards, by which the apparatus is worked from the deck. Thus, when the sail is set, by slackening away the upper haliards, the yard will descend from its own weight, and the metal rod will be put in motion by the slackening of the chain, and communicate its rotary motion to the roller spar by means of the cog-wheels, and so reef the sail to any size required; by tightening the upper haliards the sail is set. *Patent completed.*

704. W. Vernon. *A new or improved means or apparatus for communicating signals or intelligence to or from railway trains or other similar conveyances, whether they be stationary or in motion.* Dated March 16, 1863.

In carrying out this invention, the rails on the line of railway are secured to chairs which are spiked to sleepers, in which case the inventor screws or otherwise fastens to such sleepers a number of non-conductors of glass, earthenware, or other material, which form supports for, or to which is or are attached, a line or lines of conductors or conducting materials, composed of iron wires galvanized, or other metal wires or rods or bars of metal, or other conducting substance; such conducting lines extend the whole length of the railway, and they may be outside the rails of each line of railway, or between the lines of railway. He also provides telegraphic apparatus in connection with the conducting line to each station on the line of railway, and to each break van and engine, and to one or more carriages, or to either or any of them; and, in addition to the telegraphic apparatus furnished to, and in connection with, the train, he provides each carriage, van, or engine, or either or any of them, with a vertical or other rod or rods, passing through a non-conducting substance, each rod having at its lower end a truck or pulley somewhat broader than the conducting line. Above the truck is a spring, which presses down the truck on the conducting line, so that while the carriage is in motion, or as it remains stationary, it can receive a message or signal from the station it has left, or the one towards which it is proceeding, or the guard or other persons may send a message or signal to either of such stations, or may receive or send a message or signal from or to any signal-man having in his signal-box a telegraphic apparatus in connection with the conducting lines. And, in order to prevent the electric or other current from passing through or proceeding beyond the train, he provides one or more rods in connection with the apparatus in each carriage, such rod or rods being in connection with the axles of the wheels or other parts of the carriages to conduct the current to earth. The guard or other person may send forward or backwards the message he receives, or the answer thereto from his apparatus. *Patent abandoned.*

705. G. P. Beley. *Improvements in discharging projectiles below the water-line of navigable vessels and other structures.* Dated March 16, 1863.

This invention consists in constructing a porthole below the water-line of the ship, fort, or other vessel, and in causing a tube at the required time to project through the said port—the outer end of the tube being closed. Through this tube the projectile is discharged. The porthole is closed by a specially constructed cover after the discharge. *Patent abandoned.*

706. T. Powell. *An improved chopping-block for butchers* Dated March 16, 1863.

In one modification of this invention, the lower part or stem of the block is composed of a hollow cylinder or pedestal of cast-iron open-work, and having projections in the interior towards the top, so as to receive and support a slab of wood about six inches thick, more or less. Castors may be affixed to the lower part of the pedestal for convenience of removal. Although ordinary cast iron may be used for the stem or pedestal of these improved chopping-blocks, yet the patentee prefers the use of malleable cast iron, as more suitable and less liable to fracture from the blows of the chopper. The whole construction may be of a circular, oblong, rectangular, or other convenient shape, and forms a light ornamental chopping-block, much more convenient and economical than, and answering all the purposes of, the heavy unsightly solid wooden block now in use. *Patent completed.*

707. J. Smethurst. *Improvements in the construction of ships and vessels for the purpose of obtaining additional strength and motive power.* Dated March 16, 1863.

We cannot here quote the details of this invention. *Patent abandoned.*

708. W. E. Newton. *Improvements in the manufacture of iron and steel.* (A communication.) Dated March 16, 1863.

This invention relates to an improved manufacture of iron and steel, the essential characteristic feature of the process being the completion of the manufacture by the liquefaction of the metallic product, whether of iron or steel, or iron more or less steely. *Patent completed.*

709. W. G. Eavestaff. *Improvements in the construction of pianofortes.* Dated March 16, 1863.

This invention is not described apart from the drawings. *Patent completed.*

710. J. H. Brierley and B. Greenwood. *An "All England" cricketers' clasp.* Dated March 17, 1863.

Provisional protection has not been allowed for this invention.

711. J. H. Brierley and B. Greenwood. *An album belt.* Dated March 17, 1863.

Provisional protection has not been allowed for this invention.

712. W. H. Atkinson. *Improvements in studs or fastenings adapted to holding together parts of shirt fronts, wristbands, collars, gloves, and other articles of wearing apparel.* Dated March 17, 1863.

This invention consists of certain improvements in the construction of studs or fastenings, the object of which is that such studs or fastenings shall be adaptable to eyelet holes, instead of to the ordinary button holes, and also that the studs shall be applied and fastened to the garment without any derangement or creasing being caused thereto by the application of such stud or fastening. *Patent completed.*

713. W. E. Gedge. *Improvements in the modes or means for framing pictures, looking glasses, and other objects.* (A communication.) Dated March 17, 1863.

This invention is not described apart from the drawings. *Patent completed.*

714. W. H. Emett. *Improvements in processes for facilitating and combining the art of writing with engraving together on stone, applicable to maps, plans, specifications, and other lithography, which improvements are also available for transfers to zinc or stone, or printing from original.* Dated March 17, 1863.

In carrying out this invention, the lithographic stone is prepared by first graining, as for chalk drawing; the surface of the stone is then polished, after which the stone is burnished, taking care to keep the surface free from dust. The face of the stone is then covered over evenly with strong gum, allowing it to remain for some few hours, say from six to ten hours. When the tracing of the work to be drawn is completed, the gum is removed from the stone by washing almost the whole from the surface with a clean sponge. The stone should be now fitted in a lithographic press, and the surface damped with a little water, leaving no water on the stone more than necessary for securing a good copy of the tracing. The tracing is then placed on stone reversed, as is usual for a transfer in lithography, and pulled quickly through press; the impression will be found much firmer if pulled twice without lifting up the tympan, and the impression will then be transferred on to the stone, and quite fit for the engraving and ink work. The tracing must be made by using ivory black, mixed with a little water of about the consistency of lithographic ink, and a lithographic crow quill, or any pen that will produce a good firm line, should be used, as the firmness of the tracing ensures the better quality of work when transferred from tracing paper. In commencing the drawing and writing, the thick lines of the latter are to be executed first, then the thick or shadow lines of drawing. The work thus described must now be etched very slightly with a little weak diluted nitric acid and gum water, care being taken not to etch away the tracing that up to the present is not drawn. When the stone is quite dry, it should be slightly covered with a little red or black chalk, usually employed for showing the fine engraved lines on stone; the fine lines of writing and drawing can then be engraved with an ordinary stone engraver's point, or a diamond if necessary. When all the work is finished, the surface of the stone should be covered with a coat of sweet oil, which should remain on the stone from five to ten minutes, and then be removed with a clean sponge. The work is to be rolled-up distinctly by a good soft roller. Those generally used for printing stone engraving will be found suitable for the purposes of this invention. The work thus executed is fit for making re-transfers to stone, zinc, or otherwise printing from original. *Patent completed.*

715. John Cox. *Improvements in swimming baths and in apparatus for swimming, part of which apparatus is applicable to sailing or moving vessels in a circle.* Dated March 17, 1863.

The first part of this invention consists in introducing a false moveable bottom into swimming baths, such false bottom being formed, by preference, of a wooden frame to fit the bottom of the bath. The frame should be clad across or longitudinally with, by preference, spars of wood and bars of iron of sufficient strength, and about an inch apart, and in such proportions as to be of a specific gravity very little more than water, so that when immersed in water it may be very easily raised. The patentee introduces the false bottom into the deep end of the swimming bath, so that it shall occupy as much of the bottom as may be considered necessary. By means of pulley work or otherwise he is enabled easily to hoist the false bottom to the surface of the water, or as far as will enable swimmers to stand thereon, and thus prevent accidents from drowning. The raising one end only of the false bottom at the deeper end will in general be sufficient, the other end being allowed to be on the bottom of the bath where the water is sufficiently shallow. The second part of the invention relates to apparatus for enabling persons to swim or propel themselves in water, and has reference to former inventions for which letters patent were granted to the present patentee on the 19th January, 1841, No. 8802, and on the 14th July, 1857, No. 1974. Instead of the propelling part of the apparatus being fixed round the leg of the swimmer (as described in the specification of the said letters patent), he fixes it to what may be called the lower end of a stilt, the upper end of which is fastened to the leg by straps or other suitable fastenings, in a similar manner to ordinary walking or rope-dancing stilts. The lower part of the stilt may be cylindrical or polygonal (solid or hollow), but of such a diameter, say 3 to 6 inches, as will admit of at least six wooden ribs, about an inch in breadth, being hinged around it, each rib being from 4 to 8 inches in length, according to the extent of propelling surface required. These ribs have cloth or other flexible materials fixed to them on the principle of an umbrella, and are prevented from expanding beyond a limited space by check-strings. Instead of cloth being used, and forming an apparatus like an umbrella as just described, he sometimes hinges flaps of wood or other rigid material to a flat surface, which flaps expand and contract like the valves of a pump. In using the apparatus, the propelling part is below the foot, which rests on a projection from the upright of the stilt, immediately above the propelling part; and the under part of the stilt is so long as to enable a person to walk on land or in shallow water without injuring the propellers. He sometimes attaches these apparatus to guide rods, to be fixed to a floating frame, for the amusement of bathers. *Patent completed.*

716. W. E. Newton. *An improved preparation for the cure of scab, foot-rot, and other diseases of sheep and cattle.* (A communication). Dated March 17, 1863.

This invention relates to a compound of ingredients which will form a black soap soluble in water, and which, when dissolved and properly diluted, will be found an excellent specific for the cure of scab, foot-rot, and other cutaneous affections to which sheep and cattle are liable. To this end the inventor takes tar, pitch, resin, tallow, or spirits, oil, or fat, or tar, coal, or peat, or the oil or gum of the Australian grass tree, or obtained from the blue, red, and white gum trees of Australia, and any one or more of these are made soluble in or mixed with water, and subsequently added to a saponaceous mass made by mixing strong caustic lyes under pressure with waste animal matters. *Patent completed.*

717. G. De Laire. *Improvements in the manufacture of brown colouring matters.* (A communication). Dated March 17, 1863.

According to this invention, in order to produce a brown colouring matter, aniline, violet, or blue dye is taken, and treated with a salt of aniline. The salt which is found the most suitable is the hydrochlorate. *Patent completed.*

718. T. N. Miller. *Improvements in heating horticultural buildings.* Dated March 17, 1863.

This invention consists in combining two modes of heating heretofore practised—viz., flues on or near the floors of such buildings, through which the heated products from

the fires pass into the chimneys, and water troughs with perforated covers, similar to those heretofore used in combination with boilers, suitable for causing water to circulate in such troughs. *Patent abandoned.*

719. W. SYMINGTON. *Improvements in the process of and apparatus used in roasting and treating coffee and other organic substances.* Dated March 17, 1863.

The patentee claims the method of saving and utilizing the aroma, volatile oil, and other products evolved during the process of roasting coffee, cocoa, chicory, and other organic substances, by combining the cylinder or vessel in which they are roasted with one or more receivers or vessels containing cold roasted coffee, or nibbed or dried chicory, or other suitable substance, either powdered or otherwise, and in a desiccated or dried state, by which the aroma or volatile oil is absorbed and rendered valuable. *Patent completed.*

720. W. WILD and J. H. RANDEL. *A new and improved mode of inlaying gold and other metals in glass, and in a composition suitable for the manufacture of jewellery and other ornaments, buttons, and other similar articles.* Dated March 17, 1863.

In carrying out this invention, when the patentees desire to inlay gold or any other metal in glass, they place the metal to be so inlaid within a mould, which is then placed at one end of a pair of pinching pliers, and having melted sufficient glass to fill the mould, they compress the pliers, and the metal remains embedded within the glass, which is then annealed, and is afterwards ready for cutting and polishing. The glass most suitable for the purpose is the kind known as Bohemian glass, as this melts at a lower heat, and takes a better polish than any other description of glass; but when this is not to be obtained, or when they desire to produce a cheaper article, they use the common kind of English glass. When they desire to inlay gold or any other metal in the composition before mentioned, they first prepare the said composition by taking about four parts of glass and two parts of enamel, which, after being well pounded and mixed in a mortar, are placed in a copper mould, with the metal to be inlaid at the bottom of the mould. They then place the said mould on a copper plate (on which is spread a thin layer of plaster of Paris), and the plate with the mould on it is then placed in an enamelling stove, over a coke fire, until the whole is well fused: it is then annealed, and when taken out of the mould is ready for cutting and polishing. *Patent completed.*

721. W. DONVALAND and D. CRICHTON. *Improvements in looms for weaving.* Dated March 17, 1863.

This invention is not described apart from the drawings. *Patent completed.*

722. J. ROBERTS and R. NAYLOR. *Improvements in organs, harmoniums, and pianofortes.* Dated March 17, 1863.

In carrying out this invention, the inventors place the key-boards, keys, or manuals of organs, harmoniums, pianofortes, German pedals, and pedal claviers on springs at the front part, or they suspend the same from springs, so that when more pressure is used on the keys than is required for playing, the keys yield, and the swell shutters or venetians open open, thereby increasing and regulating the sound. Or, as a modification of the same principle, they place a spring of india rubber, or other suitable material, under each key, and thus obtain the same result. *Patent abandoned.*

723. R. A. BROOMAN. *Improvements in the manufacture of spoons and forks.* (A communication). Dated March 18, 1863.

This invention relates to the manufacture of spoons and forks from sheet metal, as hereafter described. The inventor uses an ordinary cutting-out or stamping press, on the bed of which he places matrices, and fits corresponding stamps or dies in the head; and he changes these matrices and stamps according to the progress of the work at the particular part of the work to be performed. He first takes a frame, and adjusts therein a matrix in one or more pieces, of the contour of the spoon or fork to be made. He places this in a counter-matrix, in which there is an inclined channel for receiving and leading away the piece of metal stamped from the sheet, as hereafter explained, and fixes the frame on the bed of the press. He fits a stamp or punch corresponding with the matrix in the head of the press. He places sheet metal on the matrix, and brings down the stamp or punch, when a blank, having the outline of a spoon or fork, is cut or stamped out, which, falling through the inclined channel, is removed for the second operation, which consists in turning up in a matrix and stamp for the purpose side pieces between the part for forming the bowl or prongs and the handle. The third operation consists in turning down and consolidating the side pieces so raised by another matrix and stamp; while the fourth operation consists in hollowing out the part intended for the bowl or for the prongs by means of a matrix and stamp constructed and shaped for such purpose. The fifth, and last operation, for giving the finished shape to the article, is performed in a matrix and stamp prepared for that purpose. *Patent completed.*

724. F. RICHMOND, H. CHANDLER, and J. G. RICHMOND. *Improvements in machinery for washing potatoes and other vegetables.* Dated March 18, 1863.

This invention consists in an improved mode of constructing the cylinders or drums in which potatoes or other vegetables are washed. The cylinder or drum is formed with a cast-iron or other frame, furnished with trunnions supported in bearings fixed to the ends of the trough containing water, as usual; one half of the cylinder or drum is loose, and it is provided with handles, by which it is easily removed from the frame in which it fits, and the other half is hinged to the frame, the two halves being connected together and to the frame by a spring catch or otherwise. The circumference and ends of the cylinder or drum (or the circumference only) are made with strips or bars of galvanized iron, or other suitable material. By this means the loose part of the cylinder or drum is easily taken out to remove the potatoes or other vegetables when washed, and to replace a fresh supply to be washed; and, in some cases, the machinery may be supplied with two loose portions, to save time in removing the washed and supplying the unwashed vegetables. *Patent completed.*

725. W. E. TAYLOR. *Certain improvements in machinery for reeling, winding, warping, and beaming yarn.* Dated March 18, 1863.

This invention consists in giving rotary motion by bands and pulleys to the spindles on which the cops or bobbins are placed, whereby any additional amount of twist can be given to the yarn in proportion to the speed at which the spindles are made to revolve. The inventor fixes the bobbins on stationary spindles, and draws the yarn through a guide placed in line with the axis of the bobbin. The flange over which the yarn is drawn is made of metal or other material having a polished surface to prevent friction; or a light flyer is mounted on the fixed spindles to guide the yarn, and by this means the tenderest yarn can be mounted without breaking; when the yarn is drawn off from the upper end of the bobbin, an additional twist for each layer on the bobbin is put in the yarn. When it is requisite to give a greater amount of additional twist to the yarn, he imparts rotary motion to the spindles and bobbins by means of bands and pulleys, the velocity imparted to the spindles depending upon the quantity of additional twist to be given. *Patent abandoned.*

726. H. KILSHAW. *Certain improvements in looms for weaving.* Dated March 18, 1863.

The object of this invention is to vary the motion of the lay, so as to obtain the requisite swell for the passage of the shuttle across the shed. In looms of the ordinary construction, the crank shaft is connected to the lay by means of rigid connecting arms or links. Now this invention consists in making the connecting links with a joint at or near the centre of their length. The end of the link jointed to the lay is provided with two stop pieces bearing alternately against the lay swords above and below the joint pin; the joint in the connecting links allows them to yield in turning over the back centre of the cranks, thus producing the required swell in the motion of the lay. The upper stop piece comes against a spring for assisting the connecting link back to the lower stop. *Patent abandoned.*

727. B. WREN. *Improvements in cleansing and treating certain descriptions of wheat and other grain.* Dated March 18, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

728. E. LEGRIS. *A new or improved machine for thrashing out the seed of flax.* Dated March 18, 1863.

The object of this invention is to separate the seed from the stalk of flax in a similar manner to the present system of hand labour; and the machine by which the inventor effects this purpose is composed of a bench or frame, and an apron or feeding cloth to spread out or lay the flax to be thrashed, also of beaters or mallets, having blocks at the end, of about 20 in. long by 16 in. wide, which are made to fall upon the flax with a shock by means of a series of cams placed spirally on a shaft. Any motive power may be used; if steam or horse power, motion may be given to the driving shaft by means of fast and loose pulleys; if hand power be used, by a crank placed on the side of the shaft near the pulleys, or on the fly-wheel on the other side. A fly-wheel may be added to regulate the broken or checked motion of the cam shaft. The beaters, being raised by the action of the cams about 16 in. or 21 in. above the bench, and suddenly abandoned to themselves, fall with a certain shock, similar to the blow of the workman in hand thrashing. The flax spread on the feeding cloth may be easily turned during the working of the machine, and a perfect thrashing be effected. *Patent abandoned.*

729. T. OLDKNOW. *Improvements in the construction of jacquards employed in bobbin net or twist lace machines.* Dated March 18, 1863.

Under the centre of what is known as the Manchester top, the patentee places a threefold sley of wirework, consisting of horizontal bottom or horizontal or bottom sley, a front side or front sley, and a back side or back sley. The said front bottom and back sleys are formed of wires bent at right angles; the ends of the wires which form the front and back sleys are connected to other wires or plates at right angles to them, and are secured by twisting them with lighter or thinner wire, or by rivetting or soldering them together. The centre portion of the wires which form the horizontal sley are crossed at right angles by other wires. The horizontal or central sley is provided with as many strings or wires as there are holes in one side of either of the cylinders, when two cylinders are used, or with half as many strings or wires as there are holes in one side of the cylinder, when one cylinder only is used. In front of the central or horizontal sley are the strings or wires belonging to, or to which motion is communicated by, the front wires and the front cylinder when two cylinders are used; and at the back of the central or horizontal sley are the strings or wires belonging to, or to which motion is communicated by, the back wires and the back cylinder when two cylinders are used. Each of these wires or strings is provided with a dropper of the required size; these droppers are divided into three several sets in three distinct boxes; the strings or wires to the droppers in the front box are also attached to one end of a thin metal jack lying in the front and back sleys; such jack is also attached to the wire or strings of what may be denominated No. 1 droppers in the centre and back box, and so on with every other subsequent number, so that when a selection is made by the front cylinder on the front wire in the front box, a selection is also made of the droppers in the central box; hence, by the employment of six cams instead of four as heretofore, and by using three driving bars instead of two driving bars as heretofore, he is enabled to make a selection of the droppers in the front and centre box, or in the back and centre box, by which means he thus moves all the threads which are passed through the bars operated upon by the droppers to the right or left, either wholly or in part, or right and left (according as the cards are punched), during the time which is occupied by the carriages leaving such threads and returning to them, both in the front and back motions of the machine. *Patent completed.*

730. F. NORRINGTON. *Improvements in girths or bands and knee-caps for horses.* Dated March 18, 1863.

In constructing a saddle girth, the patentee forms it of a strip of vulcanized india-rubber, or of a strip of vulcanized india rubber combined with cotton or woollen fabrics, in the same way as india-rubber belting is now commonly made; and to each end of the strip is connected a buckle. This he does, by preference, by making the ends of the strip double, each end of the strip being for this purpose turned over before the strip is vulcanized; the end of the turned-over portion of the strip is caused in the vulcanizing process to join with the strip, but the whole of the turned-over portion is not allowed to do so: a hole is thus left between the strip and the turned-over end; through this hole the bar of a buckle is passed. The buckle at each end of the strip carries three, or it may be other number of, small buckles, which, when the girth is being girthed to the horse, are made to receive the saddle straps. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated July 10, 1863.

1725. T. Legg, Northampton-square, machinist, and R. Griffith, Exmouth-street, machinist. Improvements in the construction of sewing machines.

Dated July 28, 1863.

1869. R. Dawson, 16, Craven-street, Strand, gentleman. An improved method of annihilating or extinguishing fires.

Dated September 19, 1863.

2306. L. F. Chezand, 3, Rue des Capucins St. Jacques, and H. J. Christen, 6, Rue Neuve d'Orleans, Paris. Improvements in printing postage stamps, bankers' bills, shares, and other similar documents, and in machinery employed therein.

Dated September 22, 1863.

2334. G. M. de Bayelt, 16, Stamford-street, gentleman, and J. E. Pigoulête, 22, Pitt-street, Fitzroy-square, analytical chemist. An improved method of compounding by agglomeration artificial fuel.

Dated September 30, 1863.

2395. H. E. Skinner, Shadwell. A new kind of conical packing for taps.

Dated October 1, 1863.

2405. F. Reid, Liverpool, produce broker. Collecting and saving the spirit or alcohol generated by spontaneous fermentation in raw sugar, concrete, melado, and molasses, and thrown off during the process of boiling or refining.

2407. W. E. Newton, 66, Chancery-lane, civil engineer. Improved apparatus for cleaning rice and other grain. (A communication.)

2409. P. Leslie, M.D., M.R.C.S., Eastbourne, Sussex. Improvements in preserving the bottoms of ships or vessels and other surfaces from the prejudicial effects of marine animals and vegetables.

Dated October 2, 1863.

2413. J. E. F. Lüdeke, 2, Stonefield-street, Islington, and M. Fischer, 28, Rue Taitbout, Paris. Improvements in obtaining motive power.

2415. J. Tees, Glasgow, packing manufacturer. Improvements in packing for stuffing-boxes and pistons.

2417. W. E. Gedge, 11, Wellington-street, Strand. An improved penholder and feeder. (A communication.)

2419. W. A. Torrey, New York. Improvements in lubricating the axles of railway carriages. (A communication.)

2421. G. and W. T. Shepherd, Great Grimsby. Improvements in restoring the crystals of lump or refined sugar which has been divided by saws, and in apparatus employed for this purpose.

Dated October 3, 1863.

2423. J. Schofield and J. Kirk, Rashcliffe Iron Works, Huddersfield, millwrights and machine makers, and W. Spivey, mechanic. Improvements in looms for weaving.

2425. E. B. Wilson, 10, Strand, engineer. Improvements in the manufacture of iron and other metals, and in the apparatus employed therein, parts of which are applicable for other purposes where high temperatures are employed, and also for ventilation.

2427. E. Pratt, Nottingham, lace manufacturers. Improvements in finishing woollen fabrics made on twist lace machinery.

Dated October 5, 1863.

2429. W. Hochl, C. Brakell, and W. Günther, Oldham. Improvements in rotary engines worked by steam, water, or other motive power.

2431. J. M. and J. Stanley, Sheffield. Improvements in propelling.

2433. J. W. Guilmette, Manchester, manufacturing chemist. An improved substitute for whiting, pipe clay, and other analogous substances to be employed to produce a white coating or surface.

2435. G. H. Ellis, Wellington-road, Bromley. Improvements in, and application of, apparatus for aiding the combustion of fuel.

2437. T. Ivory, Edinburgh, advocate. Improvements in steam engines, and in furnaces and boilers for the same.

2439. R. Pepper, Sheffield, brewer's clerk. An improved machine for pressing or crushing spent hops.

Dated October 6, 1863.

2441. S. Mathews, Birmingham, gunmaker. Improvements in breech-loading firearms.

2445. W. Batchelour, Finsbury Pavement, doctor of medicine. An improved apparatus for moulding and modelling palates, teeth, and gums for dental purposes.

2447. A. Johnston, Comely Bank, near Edinburgh, gentleman. Improvements on railway carriages.

Dated October 7, 1863.

2451. J. Caddick, Birmingham, tool maker. Improvements in the manufacture of runners, runner notches, and top notches for umbrellas and parasols.

2453. C. P. Button, 27, Leadenhall-street, merchant. Improvements in lamps, especially applicable to hydro-carbons. (A communication.)

2455. C. P. Button, 27, Leadenhall-street, merchant. Improvements in harrows. (A communication.)

2457. A. Rigg, jun., Chester. Improvements in apparatus for propelling vessels.

2459. J. Gibson, Ryhope Colliery, Sunderland, engineer. Improvements in cast-iron pit-tubing.

2461. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the permanent way of railways. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated October 9, 1863.

2473. L. Lefebvre, 9, Cecil-street, Strand, physician. Improvements in vapour bath apparatus.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, October 20, 1863.

1412. N. Walton. Drying and airing clothes.
1433. R. A. Brooman. Distillation of bituminous substances. (A communication.)
1438. H. F. McKillop. Compositions for coating or covering ships' bottoms.
1442. W. Roberts. Steam boilers.
1444. J. Brooke. Miners' lamps.
1446. T. Evans and E. Hughes. Applying one or more colours of ink to type in letter press printing by hand.
1450. T. M. Harrison. Metallic casks.
1462. J. Johnson and W. Braithwaite. Reversing levers for locomotive engines and others.
1469. J. C. Wilson. Unhusking rice and other seeds.
1470. G. Bedson. Cupolas and blast furnaces.
1471. T. C. March. Ornamentation or decoration of articles of furniture.
1473. R. Hughes. Scraping and sweeping turnpike and other highways, &c.
1477. J. Jones. Gas regulators.
1482. R. Blackburn. Traction engines.
1483. T. A. Elliott. Construction of, and ballasting, ships and other vessels.
1486. M. B. Westhead. Adapting tapes, ribbons, &c., to surfaces from which they may be unwound or rewound.
1488. H. G. W. Wagstaff. Feeding steam boilers with water.
1489. S. Robson. Steering apparatus.
1490. J. Shand. Steam fire engines, and steam boilers for the same.
1492. J. Forrester. Bricks, quarries, slabs, tiles, earthenware pipes, &c.
1495. I. B. Harris. Flexible and other tubes.
1505. J. Lightfoot. Fixing mordants in the processes of dyeing and printing textile fabrics or yarns.
1506. J. G. Jennings and M. L. J. Lavater. Moulding and vulcanizing articles of india rubber.
1510. W. Neill. Steam engines.
1517. J. F. Spencer. Tube joints.
1519. F. de Wyldé. Preservation of lead surfaces. (A communication.)
1524. J. A. Sparling. Twisting and winding silk.
1527. D. Barker. Treatment and preservation of yeast.
1530. R. Jobson. Machinery for making moulds.
1536. H. A. Bonneville. Machinery for the manufacture of bolts and rivets. (A communication.)
1547. R. Brownlee. Sawing machinery.
1559. W. Clark. Treatment of broom for the manufacture of paper pulp. (A communication.)
1577. J. Ellison and A. Rogerson. Slubbing intermediate and roving frames in throstles and winding machines.
1593. S. Smith. Liquorice.
1604. H. G. Craig. Preparing iron and other metal plates for shipbuilding and other purposes.
1629. C. H. Gardner. Lithographic and zincographic presses.
1668. H. A. Bonneville. Telegraphic wires. (A communication.)
1704. J. Thomas. Treating ores and earths containing iron.
1733. E. D. Chattaway. Railway signals.
1752. H. A. Bonneville. Breech-loading firearms. (A communication.)
1776. C. G. Glemm. New employment of magnesia.
1808. W. Simpson and J. Hutton. Hollow cutting tools.
2039. H. A. Bonneville. Processes in spinning wool. (A communication.)
2057. W. Jackson. Sewing machines.
2080. R. Griffiths. Retorts or ovens.
2129. C. Harratt. Tilling land.
2173. C. Jackson. Bolts.
2179. H. A. Bonneville. Attaching horses to carriages. (A communication.)
2180. H. A. Bonneville. Machine for glossing and glazing all kinds of threads. (A communication.)
2192. J. Rowell. Construction of fences, gate-posts, &c.
2356. J. Webster. Utilizing the waste flux from galvanizing works.
2388. H. Haigh and R. Heaton. Dyeing cotton.
2473. L. Lefebvre. Vapour bath apparatus.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed October 16, 1863.

978. P. G. Rowell and H. Holt.
985. A. Ford and R. Rigg.
986. H. Rafter.
988. E. L. Simpson.
990. M. Runkel.
991. J. W. Nottingham.
992. H., E., S., and J. Yeadon.
996. W. Campion and G. Wilson.
997. W. Ryan and W. Daniel.
999. T. Settle.
1005. J. Lee and E. Dawson.
1012. T. Richardson and J. C. Stevenson.
1014. J. Cavanah.
1015. J. B. Daines.
1016. W. N. Wilson and J. G. Grey.
1023. J. Thompson.
1024. J. Thompson.
1028. C. Pooley.
1030. S. Harrison.
1038. C. Beyer.
1039. I. Dimock.
1089. W. Clark.
1105. S. J. Bartlett.
1111. J. M., E., and C. Johnson and L. Bertling.
1113. G. Haseltine.
1123. J. H. Knott.
1126. S. B. Cochran.
1147. J. B. P. A. Thierry.
1288. W. E. Newton.
1289. W. E. Newton.
1327. W. E. Newton.
1369. A. V. Newton.
1420. J. G. Jones and R. Ridley.
1650. F. Ransome.
1807. F. J. Mavor.
2059. T. Howard.
2069. G. T. Bousfield.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2491. M. Strang.
2496. R. A. Brooman.
2497. M. Deavin.
2651. W. T. Vose.
2503. G. Davies.
2510. A. McDougall.
2514. P. R. Smith.
2525. W. Henderson and J. Down.
2528. W. Clarke and S. Butler.
2538. T. J. Marshall.
2544. A. V. Newton.
2547. J. Macintosh.
2552. J. Thompson, E. G. and F. A. Fitton.
2553. J. Jack and D. Rollo.
2555. C. Hoare.
2558. J. Burch.
2561. W. Jamieson, W. Robinson, and C. Rowbottom
2654. W. E. Newton.
2676. C. Harratt.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2414. G. Collier.
2419. E. Tombs.
2462. H. Deacon.
2443. L. J. P. de Mirimonde.
2494. L. A Desachy.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending October 17, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
471	2 0	480	0 10	489	0 10	497	0 4	505	0 4	513	1 2
472	0 4	481	0 4	490	0 10	498	0 10	506	0 4	514	1 4
473	0 10	482	0 8	491	0 8	499	0 8	507	0 8	515	0 4
474	0 10	483	0 4	492	0 8	500	0 6	508	0 4	516	0 10
475	0 4	484	0 10	493	0 4	501	0 8	509	0 4	517	0 4
476	0 4	485	0 4	494	0 6	502	0 4	510	0 8	518	0 8
477	0 4	486	0 4	495	0 4	5 3	0 6	511	0 4	519	0 8
478	0 4	487	0 4	496	0 8	504	0 4	512	1 6	520	0 8
479	0 6	488	0 4								

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		£	s.	d.		£	s.	d.	p ct
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Nail Rods	do	8	0	0		8	10	0	
Hoops	do	10	10	0		0	0	0	
Sheets, single	do	11	10	0		0	0	0	
Staffordshire Bars	do	9	10	0		0	0	0	
Bars, in Wales	do	6	10	0		6	15	0	
Rails	do	6	15	0		0	0	0	nett
Foundry Pigs, at Glasg, No 1	do	3	0	0		3	7	0	
Swedish Bars	do	11	10	0		12	10	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		16	10	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	105	0	0		0	0	0	3
Hammered Bottoms	do	115	0	0		0	0	0	
Flat Bottoms, not Hamrd	do	110	0	0		0	0	0	
Tough Cake and Ingot	do	98	0	0		0	0	0	
Tile Copper	do	98	0	0		0	0	0	
Best Selected	do	101	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8¼		0	0	9	
Fine Foreign	per ton	99	0	0		102	0	0	
TIN:—									
English Block	per cwt.	5	15	0		0	0	0	2½
do Bar	do	5	16	0		0	0	0	
do Refined	do	6	0	0		0	0	0	
Banca	do	6	2	0		6	3	0	nett
Straits	do	5	17	0		0	0	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	9	0		1	10	0	
Second Quality	do	1	7	0		1	8	0	
Coke	do	1	3	6		1	5	0	
LEAD:—									
Pig, English	per ton	21	7	6		21	10	0	2½
" Spanish Soft	do	19	7	6		19	10	0	
Shot, Patent	do	23	10	0		0	0	0	
Sheet	do	20	10	0		20	15	0	
White	do	27	0	0		27	10	0	
SPELTER:—									
On the spot	do	18	7	6		18	10	0	nett
ZINC:—									
English Sheet	do	24	0	0		0	0	0	2½
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Quebec, red pine	3	10	4	10
" yellow pine	3	10	4	10
St. John, N.B., yellow	0	0	0	0
Quebec oak, white	5	10	6	10
" birch	3	10	4	10
" elm	3	10	5	0
Dantzic oak	3	10	6	10
" fir	2	10	3	10
Memel fir	3	5	3	10
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
" yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
" St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
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Yellow pine, per reduced C.				
Canada, 1st qual.	17	0	18	0
" 2nd do.	11	0	12	0
Archangel, yellow	£13	0	13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
" white	9	0	9	10
Gefle, yellow	10	10	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12ft by 3 by 9 in.				
Christiania, yellow	21	0	23	0
DeckPlank, Dantzic, per 40 ft. 3 in.	0	14	1	4
PUMICE STONE pr ton	5	10	9	0
OILS, &c.				
Seal, pale ...per tun	45	0	0	0
Sperm body	78	0	80	0
Cod	56	0	0	0
Whale, Sth Sea, pale	43	10	44	0
Olive, Gallipoli	59	0	60	0
Cocoanut, Cochin	47	10	48	0
Palm, fine	38	10	39	0
Linseed	42	15	43	0
Rapeseed, Eng. pale	43	0	43	10
Cottonseed	31	0	39	0

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THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 30, 1863.

BOILER EXPLOSIONS.

THERE is, perhaps, hardly a subject within the range of human knowledge, which has been invested with such mystery as boiler explosions. Almost every agency of nature, has been called in to account for those fearful catastrophes which have desolated happy homes, and but too often extended misery far and wide. Merely to attempt a recapitulations of the various theories advanced to account for the tremendous effects produced by the violent rupture of a steam generator, would fill pages; while an extensive library would scarce contain the reports of innumerable discussions and controversies, elicited by the promulgation of the different opinions held by the authors of these various theories. Able mathematicians; clever engineers, standing high in their profession; continental *savants;* American philosophers; have alike devoted their time and energies to the investigation of a question, apparently abstruse, yet of the utmost practical importance to those who employ steam power. We certainly regard is as remarkable in the extreme, that these men have, one and all, overlooked the fact that, in the operation of getting up steam to the working pressure required, an amount of power is stored up within every boiler, almost without exception, sufficient to account for the most disastrous explosions on record. The mathematical investigation of this truth, we may safely leave in the hands of such men as Airy and Rankine; but the MECHANICS' MAGAZINE is perused by thousands, who have neither the time nor the ability, to study and comprehend profound mathematical disquisitions. We, therefore, once more place our explanation of the matter before our readers, convinced as we are that the violence of a boiler explosion, is as much the result of simple laws of nature, as the succession of day and night, or the fall of a body under the influence of gravitation.

It is impossible to communicate heat to water without immediately developing power, which we may or may not subsequently render available by means of a cylinder and piston. Every pound of coal consumed in a steam-boiler furnace, represents a certain amount of force, either stored up for future use, or conveyed at once to the steam engine, and through its agency distributed in various ways. Explosions occur at various pressures; and the measure of their violence is, other things being equal, the quantity of coal required to raise the steam from zero to the pressure existing within the boiler at the moment of the explosion. This will, of course, vary with the pressure, the quantity of the water, the quality of the coal, and the construction of the boiler. But it may be in all cases approximately calculated from the quantity of fuel consumed per hour. For the sake of illustration, we will suppose the case of a boiler, of the simplest construction, of fifty effective horse-power, burning 300 lbs. of coal per hour. Such a boiler will probably require some sixty minutes to get up steam from cold water to a working pressure of 60 lbs. per square inch. The same quantity of fuel will be burned during this hour per square foot of grate, as though the engine were at work. Now, 50-horse power exerted for an hour, is equivalent to 1,650,000 lbs. raised a foot high per minute, or to 99,000,000 foot-pounds, if the whole exertion of force, instead of being extended over an hour, were concentrated in a single minute. Now, we have seen that power is continually—to make use of a metaphor—poured into the boiler for an entire hour, in the act of raising the steam. On starting the engine, the further accumulation of force within the boiler is arrested; but none of that already stored up is withdrawn until the pressure falls below 60 lbs. per inch. Were it possible to avail ourselves of all the energy retained in the boiler, it would suffice to raise 99,000,000 of pounds a foot high in one minute were the fire withdrawn. Owing to the imperfections of machinery, and other causes on which we need not dwell, this we cannot do. Still the power is there, and cannot disappear, unless the steam is withdrawn from the boiler or this last suffered to cool down. "Power may be wasted, but it is never lost." When a boiler explodes, it is probably torn into fragments in a minute fraction of a second, and the entire amount of force, due to the combustion of 300 lbs. of coal, is called into action and extorted in that space of time. Even though the catastrophe lasted one entire second, the heat stored up in the water would exert a force great enough to raise 99,000,000 lbs. a foot high!—that is, the entire work of fifty horses exerted for an hour, concentrated in one second. The only thing remarkable is, that explosions are not more destructive than they are.

We have given this calculation to our readers, as though the heat employed in raising the water from 60 deg. to 212 deg. should properly be included in the total, from which the amount of work done by an explosion may be deduced. This is a point, however, open to discussion; and as a quarter of an hour, would probably suffice to raise the steam to 60 lbs. in our supposed boiler, from water at 212 deg., we prefer to divide the number of foot-pounds given above by four, the result still giving an amount of power sufficient to produce the most destructive results by its sudden exertion. It is not necessary to call in exploding hydrogen, electricity, or any of the occult forces of nature to account for the ruin of buildings or the destruction of life and property.

Simple as all this is thus far, and easily as the *violence* of an explosion may be explained, we find the causes which lead to the first rupture of a boiler surrounded by much that is mysterious. The primary cause of an explosion is a rupture above the water-line, and we have already pointed out the sequence of events, in our number for Sept. 18th. Whether this rupture is the result of congenital weakness, or of corrosion, depends on particular circumstances not easily ascertained in most cases. The singular effects produced on the plates of a boiler by oxidation, trituration, vibration, &c., have received much attention, and an amount of research has been expended on this branch of the subject which will, we trust, soon divest it of the uncertainty which hangs around it at present.

In order to understand the *rationale* of a boiler explosion, it is only necessary to comprehend the following facts:—Every body of water is made up of an assemblage of spherical particular atoms, capable of free motion on each other. When heated, the atoms of water within a boiler are surrounded by, so to speak, an atmosphere of caloric, tending violently to repel each one from its fellows. This force is equilibriated by the pressure of the steam in the upper portion of the generator, resting on the surface of the liquid, and thereby forcing the constituent atoms into propinquity. The instant, however, that an opening is made above the water-line sufficiently large to remove the pressure instantaneously, the repulsive action of the heat comes into play, and the water is separated into its ultimate atoms with a force proportionate to the quantity of heat stored up; rending the boiler into fragments, and destroying everything in the immediate neighbourhood. It is a mistake to imagine that any true dynamic steam is produced during this stage of an explosion, or that the water is dispersed in masses. Every particle repels its fellows with equal force, and it is opposed to reason, to suppose that many of the atoms can remain in that close approximation, which enables them to constitute a liquid, while others are converted into true steam: such a result would only ensue, if the explosion were sufficiently tedious to permit the caloric to pass from one part of the mass of water to another. This supposition is inadmissible under the conditions, and disproved by experiment. The dispersion of the water is usually attributed to the agency of interstitial steam, but there is evidence to prove that we are more correct, in stating *that it is due to the direct action of interstitial caloric.* The error has arisen from performing experiments, and ascertaining the effects produced by the *gradual* reduction of pressure on the surface of heated water, by withdrawing steam through a safety valve or stop-cock, a process in no way analogous to that which takes place in an explosion. A familiar instance of the direct repulsive action of heat on water, is afforded by placing a drop on a smith's anvil, and striking it with a bar of red-hot iron; the water is dispersed with a loud report, but no steam is produced. Water absolutely free from air may be heated to between 270 deg. and 280 deg., usually separating into its ultimate atoms with explosive violence, but still without producing true steam. If we regard the matter from this point of view, we see how erroneous is the idea that water can explode *per se.* As well might we state that the plates forming a boiler exploded. The water is perfectly passive in the transaction. Its particles are separated in the first instance, and these, in their turn, separate the plates which contained them the moment before. One great fact may be adduced in support of our explanation of the phenomena. There are hundreds of instances on record in which every pound of the many tons of water which the boiler contained, vanished on explosion. Yet it is certain that this water could not possibly have been converted into steam. There are, it is true, instances where boilers have burst, yet remained nearly full of water; but none of these explosions have been absolutely instantaneous, or very violent in their effects. In such cases, the catastrophe may, perhaps, be correctly attributed to the rapid generation of steam on the sudden reduction of pressure.

Steam power can never be worked with safety until we have an organized system of inspection established throughout the length and breadth of the land. There is scarcely an explosion on record which cannot be traced to the imperfect original construction of the generator, or the deterioration of the plates. We have ere now alluded to this branch of the subject, and may return to it at another time.

V. P.

THE FRICTION DYNAMOMETER.

ENGINEERS have now employed the friction dynamometer for more than twenty years. Absurdly termed a *force resister* in the prize sheets of the Royal Agricultural Society, it has been used by that body, at their (now)

quadrennial trials, for nearly twenty years. The friction dynamometer is, in fact, the only instrument by which the dynamic effect of a powerful prime-mover can be ascertained with complete accuracy, and, to the extensive use of it by agricultural engineers, is undoubtedly due the comparatively high dynamic efficiency of the portable engine. The improvement of the steam engine itself may be said to advance in a parallel line with the improvement of the instruments by which an accurate knowledge of its internal working can be ascertained. Just as the engine indicator is termed the stethoscope of the steam engine, so may the friction dynamometer be termed its force-measurer—the indicator and the stethoscope both help us to get at a definite diagnosis of the inward valves and mechanism of the respective patients, while the friction dynamometer measures the exact strength of the "giant with one idea." Strange to say, we may look in vain, in any of the treatises on the steam engine, for an account of the friction dynamometer. It is scarcely alluded to in the well-known Treatise on the Steam Engine, by the Artisan Club. In the otherwise excellent article "Steam Engine," in the *Encyclopœdia Britannica*, it is dismissed in a couple of lines. The truth is, that the friction dynamometer is only used in England by agricultural engineers. This enterprising body of men—the most progressive section of that progressive race, the engineers of this country—are members of what is quite a new profession, and this professsion is as yet without a literature. Now, we strongly suspect—and what we saw and heard at Worcester confirms us in our suspicion—that a little information on the matter will be acceptable to many of our readers. Besides, as we lately gave the numerical results of the trials, and our opinion on their scientific and commercial results, it behoves us the more to fully explain the important and remarkably ingenious instrument by which the thermo-dynamic results of the engines were obtained. In fact, if we look back to all the engine trials conducted by the Society, we see that, *de facto*, it is the friction brake that has determined the awards.

The first form in which the friction dynamemeter was used at the trials of the Royal Agricultural Society was that known under the name of De Prony. It is generally believed that this eminent man—the favourite engineer of the first Napoleon, himself a civil engineer of no mean ability—was the original inventor of the use of a friction brake as a measurer of force. This is a mistake. White, in his well-known "Century of Inventions"—portions of which were published at the beginning of the century—fully describes and illustrates a friction brake as a measurer of power. In alluding to the figure, White says:—"A gripe or brake, such as millers use to stop their windmills with, is fixed under (the fulcrum of a lever); it surrounds the wheel, and is then fastened to the end of the lever. The brake is thus pressed with greater or less force against the wheel, as the weight is placed more or less distant from the fulcrum of the lever. By these means a resistance of an equable kind is produced, capable of being adapted to *any* power it may be wished to measure, which makes this dynamometer a real *tribometer* or measurer of friction."

Ever since the introduction of the steam engine, and the more general use of water power, the necessity has been greatly felt for possessing an instrument to measure the efficiency of a prime-mover. Such an instrument gives the only means of ending the disputes between the buyers and producers of steam engines—disputes that continually occur, especially in countries where fuel is dear. Several means were proposed, but they all failed. Until the introduction of the friction brake, the only way of ascertaining the power of an engine was to compare it with the performances of another doing a similar duty, and supposed to be of a similar power. It is true that the power of an engine might be ascertained by making it wind up a weight tied to a rope, from a deep pit or mine; but the objections to the general use of such a plan are self-evident. The indicator is also a means of approximately determining the power of a *loaded* steam engine; it does not, however, give any means of ascertaining the friction, which increases with the load. Besides, the collation of mere indicator diagrams, multiplied by the number of revolutions of the engine under trial, would cause endless disputes at such competitive tests as those of the Royal Agricultural Society.

At last, after several abortive attempts to use a friction-brake for this purpose, by M. Hachette in 1811, by M. Gingenobre in 1815 (during a lawsuit between an English engine maker and his French customer), M. De Prony, in 1821, practically applied, and mathematically explained, the friction dynamometer.

Louis XVIII. was desirous of having a report on the old and new engines of Chaillot. In order to measure their dynamic effect, M. De Prony made a similar instrument to that still in use by the Royal Agricultural Society about thirteen years ago. The main shaft of prime-mover was embraced by two pieces of wood, each block furnished with a semicircular neck, like the brass shafts of a bearing. The two pieces were screwed up on the shaft by means of a bolt on each side. Attached to the wooden clips, was a long lever, furnished with a weight. The weight suspended at the end of the lever—always tending to fall—was kept up by the friction of the shaft, revolving in contrary directions at the other end of the lever. The friction could be either increased or diminished by screwing up the bolts more or less tightly. The whole of the work of the engine is thus expended in overcoming the friction, and the engine can even be entirely stopped by increasing the pressure on the brake. The weight exactly counterbalances the power exerted by the engine in motion; and indeed the instrument may well be termed a *friction balance*. The friction on the axle is evidently in the same ratio to the weight on the end of the lever, as the distance of the point of application of the weight is to the radius of the axle. Thus, the friction on the axle, multiplied by the radius of the axle, is equal to the weight on the end of the lever multiplied by the distance of the point of application of the centre of gravity of the weight. The unknown quantity—the friction, namely, on the axle—is evidently obtained by first multiplying the weight on the end of the lever by the distance of the point of suspension at the centre of gravity of the weight, and then dividing this product by the radius of the axle. Knowing the friction on the surface of the bearing, we can then ascertain the number of revolutions of the bearing per second or per minute. If, after measuring the circumference of the bearing, we multiply this circumference by the number of revolutions it makes per minute, and by the friction (ascertained as above) exerted upon that surface by means of the weight on the end of the lever, we get a product giving us the dynamic effect of the engine per minute—the real horse-power. In this calculation, we have not taken into account the weight of the lever itself and the scale in which is placed the weight. The lever may be either counterbalanced, or its weight at its centre of gravity taken into the calculation.

The Royal Agricultural Society soon felt the usual difficulties attending the use of this particular form of the instrument. In the first place, its use was attended with a certain amount of danger, and some dexterity and experience were required from the operator at the brake-screws. A too great tightness at the bearing had a tendency to suddenly carry round the brake on the devoted head of the operator. Besides, the surfaces had to be continually lubricated with a stream of soap and water, which, however, did not always prevent the wooden collar from getting on fire through the friction. In any case, the continual vibrations of the weight caused by the unequal side-friction on the clips, evidently led to some inaccuracy; the leverage got less as the weight rose higher, and the truth of the deductions was evidently thus affected. Before the introduction of the present excellent brake by the Consulting Engineer of the Royal Agricultural Society, many attempts were made, by several eminent men, to improve the apparatus. Fourneyron, when ascertaining, in 1829, the power of his well-known turbine, adapted a solid segment of a circle to the end of the lever. The centre of the segment was the centre round which the weight had to oscillate, and the leverage of the instrument was thus unaffected by any slight vibrations. At about the same period, Dr. Alban—the prophet of high-pressure steam; the author of the well-known work on the high-pressure engine; the enthusiast, who, when doctor to a hospital, was turned away for converting the *lavement* syringes into small steam engines—also attempted to improve the friction balance. He regulated its vibrations by means of a Watt's centrifugal governor. The governor was connected to one of the brake screws, by means of gearing. An increased speed of the engine under trial influenced the governor, which then screwed up the screws tighter, and thus slackened the speed of the engine; a slower speed, of course, brought forth a contrary action. The most important improvement, however, on the old lever brake, was thas of M. T. Barrois in 1829. The brake was adjusted to work below the engine shaft, and at an angle of 45 deg.: any vibration was thus immediately checked by the increasing leverage. Our limits will not allow us to allude to all the variations of the old friction brake—all these variations, however, point to the great store set by scientific men on this important instrument.

The first step made by the Royal Agricultural Society towards the adoption of its present form of brake was about ten years ago. The Society adopted a plan proposed by a Mr. Balk, formerly, we believe, of Ransomes and Sims, Ipswich, and who received a silver medal for his plan. It will be found described in Specification No. 1452, A.D. 1854. The strap of the brake is "connected to the end of an unequally-armed lever, which causes any shifting of the strap to increase or decrease its pressure on the friction wheel." We believe that this brake was first used at the Lincoln Meeting; but it did not act satisfactorily, and its employment led to disputes amongst the eager competitors. At the succeeding trials, the Royal Society adopted its present well-known form of brake, the action of which really leaves nothing to be desired.

The simple means of carrying out the compensating principle—doing away with side-friction—is stated to have been originated by Mr. J. G. Appold, the same man who has given

his name to a form of the centrifugal pump. It is embodied in Specification No. 13,586, A.D. 1851, in an apparatus originally proposed "for regulating and ascertaining the labour performed by prisoners." Mr. Appold also specifies the placing of the weight in a vessel filled with water—the same plan adopted with the weights on the brakes of the Royal Agricultural Society. "The water greatly resists any sudden alteration of the position (of the weight), but it can move *slowly* with little resistance from the water." A counter, driven by an eccentric on the brake-shaft, gives the number of revolutions of the brake. The present strap, as is well known, is in two halves, connected to a link, fixed to the framing at the bottom end of this link. Each half, of course, pulls the link in an opposite direction. About the same time as the temporary adoption of Mr. Balk's brake, Messrs. Clayton and Shuttleworth, of Lincoln, proposed the present plan of making the bearing part of the strap of separate small wooden blocks—an arrangement already in use for the brakes of cranes, cornmills, and similar machinery.

Of course, the plan adopted by the Royal Agricultural Society for calculating the power given out at their brakes is on the same principle to the mode of calculation with De Prony's brake. There is, however, a slight practical difference. The friction brake used by the Society is not fixed directly to the engine shaft, as with De Prony's brake. For the sake of convenience, the motion from the engine is communicated from the engine pulley, by means of a strap, to another pulley keyed on the shaft, on which is also the brake pulley. The relative diameters of the pulleys have thus to be taken in the calculation. The entire friction brake is also on wheels, so that it can be easily adjusted to any position of the engine.

The engine being brought opposite the testing shed, its proprietor then declares its horse-power and the number of revolutions at which he wishes it to be worked. The circumference of the engine-pulley in feet is then ascertained, usually by means of a tape. The horse-power—the number of revolutions—the diameter of its pulley being thus obtained; the diameter in feet of the pulley on the dynamometer; the circumference in feet of the distance of the pointer carrying the weight (measured from the centre of the brake-wheel) being, of course, previously known—the weight that has to be put on the engine is then calculated. This is done by multiplying the declared number of horses' power by 33,000, and the product by the diameter (or circumference) of the pulley on the dynamometer. This product is then divided by the product of:—1stly, the circumference in feet corresponding to the distance of the pointer carrying the weight from the centre of brake-wheel; 2ndly, the diameter (or circumference) of the driving pulley of the engine; and 3rdly, the number of revolutions of the engine per minute. We will suppose an engine, declared to be of 8 horses' power nominal, and making 120 revolutions per minute—with a driving pulley 15 ft. in circumference. The brake pulleys of the dynamometers of the R. A. S., are 14 ft. in circumference, and the "brake path" is 17·33 ft. We thus have:—

$$\frac{8 \times 32{,}000 \times 14}{17{\cdot}33 \times 15 \times 120} = 118{\cdot}5;$$

= the weight applied to the brake.

Seven pounds of coal and 1 lb. of wood per horse-power are now carefully weighed and served out to the attendants. The fire-box is then fired, and the steam is got up to a pressure of 50 lbs. on the square inch. In order to *afterwards* ascertain the quantity of coal used in getting up steam, the coal remaining outside the fire-box is carefully weighed, and the amount consumed is taken into account at a later stage of the operations. When the steam is at the fixed pressure of 50 lbs. the regulator valve is opened, and the engine is set to run against the dynamometer. When the desired speed of 120 revolutions per minute can no longer be kept up, the engine is stopped, and the number of revolutions is noted off the counter.

Another portion of fuel is now served out, consisting of 14 lbs. of coal per horse-power. No wood was weighed out this year to relight the fire-box. As the last trials, at the Chester show, in 1858, the fire-boxes had to be swept out, and 1 lb. of wood per horse-power was allowed to the attendants for lighting the fire. When the steam is again at the required pressure of 50 lbs., the engine is again started against the brake. It is now the business of the engine-man to get as many revolutions as possible out of the engine. Every means are used to spur on the flagging energies of the steam horse. The fire is always so carefully burnt out that but a slight layer of ashes is to be seen on the grate when the engine is stopped. The coal is broken into pieces of the size of a hazel nut, and the firebars are thus obliged to be very close together. A drop of oil on the coal would affect the true results, or even a deficiency of quality in a single lump of the coal served out. When the engine can no longer keep up the speed desired—in our case 120 revolutions per minute—it is stopped, as before, and the number of revolutions recorded by the brake counter are noted down by the judges.

The duty of the engine, the *mechanical time*, the minutes of duty (convertible terms) are got by dividing the total number of revolutions recorded by the counter—at the end of whichever bout it is wished to calculate—by the number of revolutions of the brake per minute. In the instance we have shown, the speed of the brake is—

$$\frac{120 \times 15}{14} = 128{\cdot}5;—$$

120 being the declared number of revolutions of the brake per minute—15 the circumference in feet of the engine pulley—14 the circumference in feet of the brake pulley. Let us suppose that the number of revolutions recorded after the second is 15,710. Then

$$\frac{15{,}710}{128{\cdot}5} = 122{\cdot}25.$$

The mechanical time of the second experiment is thus 122·25 minutes. If we now reduce these minutes to hours and decimals, and divide the number into the 14 lbs. of coal weighed out per horse-power, we get the coals per horse-power per hour consumed by the engine. We should of course get very uncertain results if only the coal consumed during the second experiment were taken into account. "Racers," provided with fire-bricks in the fire-box—with additional water-spaces, or other means—would lay up such a store of heat as to distance their less complicated competitors. The fuel consumed in getting up the steam is, however, ascertained in the following way:—In the same ratio as the number of revolutions—numbered by the counter—at the end of the second experiment, bear to the amount of coal then consumed, so are the number of revolutions—at the cessation of the first experiment—to the quantity of coal not consumed by the engine. The amount thus ascertained is deducted from the quantity used in the fire-box during the first experiment. The difference gives the approximate amount of coal consumed in getting up steam.

In the late account, by our special correspondent, of the Worcester Show, a full description is given of the general arrangements adopted for testing the engines.

MINERAL LOCOMOTIVES.

THERE are probably at this moment some hundreds of miles of tramroad in Great Britain, worked solely by horses, on which suitable locomotive engines could be employed with the greatest advantage. It would be interesting to calculate the number of tons of coal and iron-stone, lead and copper ore, lime-stone and clay, which are transported over roads more or less resembling railways in their general characteristics, during a single year. The grand total must be something enormous; yet, except in a few isolated instances, steam power has nothing to do with the transfer of mineral wealth from the pit's mouth to the iron furnace, or the locality where the crude material undergoes those processes which render its constituents useful in the arts. Whether the gross weight is to be estimated by thousands or millions of tons, certain it is that large gangs of horses, almost invariably employed under the contract system, perform by far the larger portion of the labour involved; the payments for their services forming a very considerable item of mining expenses.

The tram roads or ways of the English mining districts are widely removed from all that constitutes a perfect road. Made up of rails of all sorts, and different sizes, spiked down to inferior sleepers, placed far apart, and bedded on what scarcely deserves the name of ballast, the permanent way is bad enough; while curves of fifty or a hundred yards' radius, are frequently combined with inclines of one in forty, and occasionally one in twenty, rendering that which is already bad very much worse. Districts where such lines are the rule, and anything better the exception, appear to be, at first sight, extremely unpromising fields for the introduction of locomotives to the exclusion of horses. The retention of animal labour, therefore, is certainly not wholly owing to prejudice. Even though it were, the feeling is strengthened by the difficulties to be encountered in the substitution of mechanism for the thews and sinews which can set the troubles of the road at defiance. Still what has been already done by many mining proprietors, can be done by others; and the advantage to be derived from the employment of steam power in regions where coals can be had almost for a few pence per ton, are so manifest, that a strong stimulus is held out to all interested. The engineer and ironmaster, the mechanist and the owner of mines, hold equal stakes in every enterprise which proposes that coal and iron shall do the work of flesh and bone; it is equally a pecuniary matter to both; and the one will be as much benefited by doing a good business in colliery locomotives, as the other by effecting an annual saving in the expenses of haulage.

The difficulties to be encountered in the designing and construction of mineral locomotives, are, after all, more ideal than actual. Although the tramway is very defective indeed as compared with our great railway lines, still, it is far superior to any of the highways, either here or in the colonies, on which traction engines convey very heavy loads with ease and certainty. Although the track on which the wheels of the engine run is uneven, it is, at all events, hard; and provided the weight on each is not too great for the capabilities of the rails, locomotion is materially facilitated, while

the machinery is spared many of the shocks and jars which it would encounter in traversing an ordinary turnpike road, however good. The colliery locomotive is, however, a very different affair, when properly designed, from either the traction engine or the gigantic machines which work our great lines of intercommunication. Partaking in a great degree of the qualities of both, properly, it should be a copy of neither; possessing only so much of the one as will suit it for proceeding over bad roads, and so much of the other as will adapt it to their specialities; particular regard being had to the question of adhesion and the distribution of weight, on which success depends almost absolutely.

The gauges of the mineral lines of Great Britain vary considerably, not only in different districts, but even on properties in the hands of the same owners. As a rule, they are very narrow, 2 ft. 9 in. being, perhaps, the average, although many lines are laid with only a 2 ft. 6 in. gauge, while others have a distance of 3 ft. or 3 ft. 8 in. between the rails. The wider roads are usually far better laid and kept than the narrow ones, though neither have much to boast of in this respect. The substitution of locomotives for horses, would tend materially to their improvement, as the feet of the latter cut up and poach the ballast, and splinter the sleepers, which absorb water and are destroyed very speedily, as well by the trampling of iron-shod hoofs, as by the effects of the weather and the passing loads. It is very difficult to secure an equal distribution of weight in engines of the ordinary locomotive type intended for such gauges as 2 ft. 6 in. and 3 ft. It is impossible to get the fire-boxes between the wheels in such cases, as the grates would be unavoidably reduced to a width of only 12 in. or 14 in. In consequence, the fire-boxes must overhang the hind pair of wheels, and their weight, coupled with that of the foot-plate and its appurtenances, is quite enough to overbalance the smoke-box end of the boiler. The hind wheels are thus overloaded, while the leading wheels may barely have weight enough on them to keep them to the rails. Yet, if we seek to make up the equipoise by extending the engine forward over the leading wheels, it at once becomes unwieldy and exposed to a violent pitching motion when travelling. The curves are in general so sharp that a greater distance than 5 ft. between the centres is inadmissible, and a length of 5 ft. or 6 ft. overhanging at each end neither adds to the good qualities of a locomotive, nor improves its appearance. All things considered, we are disposed to recommend the upright tubular boiler for all lines below 3 ft. gauge. A weight of 8 tons is sufficient for locomotives intended to work such lines, as heavier loads are more than the imperfect track can sustain. Of course, in exceptional cases, this rule may be departed from, although we doubt if much advantage will be gained by doing so, as trains loaded with more than 70 or 80 tons are seldom needed; and if more power is required, this may be better obtained by the use of two small engines than one large one. It is merely a question of the powers of endurance of the permanent way. With the upright boiler placed between the wheels, weight may be distributed with the greatest nicety; while the machinery being all outside the frames, can be attended to and repaired with the utmost facility. It is true that the centre of gravity will be raised by such an arrangement; but this is no real evil, as a speed of four or five miles an hour need seldom be exceeded; and no matter how rough the road, there is little danger to be apprehended of an overturn at such a velocity. The upright tubular boiler has received so much attention, and consequent improvement of late, and the conditions of successful construction are so well understood and so easily secured, that it now ranks very highly as a safe and economical generator for moderate powers. The gauge would have little influence on the diameter of such a boiler, suspended as it would be between the axles. The foot-plate at one end of the framing being counterbalanced by the water tank at the other, the cylinders would be affixed in a horizontal or slightly inclined position to the framing at the sides of the water tank, into which the waste steam might be wholly or partially turned from time to time as the state of the fire dictated.

For wider gauges than 3 ft., the use of the ordinary locomotive type of boiler is not only admissible but judicious. Lines laid to this width are usually much better than those which are narrower, and a heavier class of engine may occasionally be employed on them with advantage. A moderately roomy fire-box can easily be got between the wheels, by making up the deficiency in breadth by additional length. Some trouble often results with the hind springs in such cases, best overcome by using those of the volute, or elliptical construction. We need scarcely say that outside cylinders are indispensable; the valve chests being best placed above the cylinders, perhaps, and worked by a rocking shaft. Some difficulty is often experienced in affixing the cylinders to the frames, as it requires very careful fitting to make such a permanent job, that they cannot work loose. American builders almost invariably cast an "apron" on the cylinders of all their locomotives, which is bolted directly to the boiler; the steam and waste ports being formed in the body of the apron, in such a manner that suitable necks enter the smoke-box, through holes cut for the purpose, into which the steam and blast pipes are directly fixed. The cylinders, in this case, have no connection with the frames except through the guide rods and boiler. The arrangement is very simple, easily fitted up, and scarcely ever works loose; while the frames may be made much lighter, as they are spared the strain of the cylinder. By placing the valve-chests outside, much inconvenient crowding of the machinery may be avoided. Boilers, 2 ft. 9 in. or 3 ft. in diameter, placed low, on frames not more than 24 in. or 30 in. asunder, effectually prevent access to everything not outside the wheels from above, and render it necessary to provide a pit, over which the engines must be run, to oil or inspect the machinery. It is needless to point out the evils attending this system. They are sufficiently obvious.

The use of very high pressures in mineral locomotives is never to be recommended, as a rule, to which there are few exceptions. Economy of fuel is no object in most cases. Expansion is seldom resorted to, and, therefore, there is nothing to be gained from such pressures as 120 lbs. to the square inch. From 60 lbs. to 70 lbs. is ample, provided sufficient piston area is supplied; and it is far better practice to give an increased diameter of a couple of inches to the cylinder than to strain the boiler by heavy pressures. There is no reason that the ports or passages should be proportionately increased in size, as only the same weight of steam has to be worked through them, and the extra weight of cylinders is of advantage in increasing the adhesion of the leading wheels. The constant succession of shocks occasioned by a bad road strain the rivets which attach the boiler to the frame, causing leaks, which are not easily remedied when very high pressures are resorted to. Tubes leak from the same reason; and much difficulty is often experienced in keeping them tight. With moderate pressures, much of this is avoided, and the durability of the fire-box and boiler generally, is materially promoted—a matter of greater importance to proprietors than the saving of a few tons of coal per annum. In all situations where it is intended that the locomotive should do all, or nearly all, the hauling, it is extremely desirable that enough of power be provided to permit each of the engines to have at least one day in each week in the shed, in order that repairs may be effected, and the machinery cleaned and adjusted. A neglect of this precaution frequently entails serious losses, and, as an instance of false economy, is very much to be deprecated.

GUNS *versus* ARMOUR PLATES.*

MR. PARSONS, in this little book, places before the public plans for a novel method of constructing great guns on the built-up system. The Armstrong gun may be considered as the representative of all that class of ordnance which is composed of rings of wrought metal welded successively together. This principle of construction involves longitudinal weakness. It is true that the metal may not be actually torn asunder; but still, the surfaces of the chase are exposed to a strain which gradually deteriorates the iron of which the gun is composed, and leads to its ultimate destruction, in consequence of the inner tube having to sustain almost unaided the whole of the strain tending to elongate the gun. Mr. Parsons proposes to overcome the defects of the Armstrong system by forming guns of an internal tube of wrought iron or steel, constituting the bore of the piece.

"This tube is turned on the outside slightly conical, and has a screw thread of suitable form cut on a considerable portion of its length at the breech end, the remaining portion at the muzzle being left slightly conical in the opposite direction; upon the screwed portion of the tube, a series of tubes of wrought iron, steel, or homogeneous metal having a corresponding screw thread cut on their interior, are screwed so as to encase the inner tube, and upon the remaining portion at the muzzle end a tube of wrought iron, steel, or homogeneous metal is forced or shrunk, its outer end extending rather beyond and enclosing the end of the internal tube; if preferred, however, the whole of the interior tube may have a screw thread cut on its exterior, and the tube, instead of being simply shrunk or forced on, may be screwed on to it in the same manner as the rings or tubes on the breech end. A screw thread is then, in like manner, cut on the exterior of the first tubes or rings, and on a portion of the internal tube, and another series of the tubes or rings are screwed on, and this process is repeated until the requisite thickness is obtained. For muzzle-loading guns the breech is closed by a plug, screwed into the internal tube, which is further secured by a breech screw behind it, secured into one of the outer rings or tubes. Should the gun be intended for a breech-loader, such modifications as the description of breech-loading arrangement require would have to be made. The tubes are so put together that each successive layer of rings or tubes will be in a state of tension upon, and compress the layer which it encloses, and this may be effected either by making the outer rings or tubes the requisite amount smaller than the inner tube and rings upon which they are intended to be secured, and expanding the outer rings or tubes by heat, then screwing them on and allowing them to contract by cooling, or by properly adjusting their sizes, and then forcibly screwing the rings on to their intended position, and thus subject them to the desired initial strain. When the rings or tubes encasing the inner tube are in separate pieces, it is essential that the different layers or series of rings or tubes should break joint with one another, so that they may be united into one mass, and impart longitudin[al]

* "Guns *versus* Armour Plates; a Practical Treatise on Great Guns." By P. M. PARSONS, C.E., A.I.C.E. London: Mitchell, 1863.

strength to the inner tube forming the bore of the gun; for this reason, not less than two layers besides the inner tube forming the bore of the gun, should be employed; and if these united provide the requisite longitudinal strength, and greater transverse strength be required, an additional layer or layers outside these may be simply shrunk or forced on without screwing. The inner tube and the rings may be made by any of the well-known processes now in use; but I consider the Armstrong or coil system may be advantageously used in connection with this mode of construction, as it provides a sufficient amount of longitudinal strength even to allow for occasional faulty welds in the tubes.

"It will be seen, that in guns so constructed, the tubes or rings surrounding the inner tube impart longitudinal as well as transverse strength to it, so that the whole mass of metal of which the gun is built up, is made available to resist the longitudinal as well as the transverse strain."

Mr. Parsons also proposes to strengthen our existing cast-iron guns by removing some of the metal by boring, and replacing this by slightly-conical wrought-iron lining tubes, forced in by hydraulic pressure. Our author is careful to supply his readers with calculations lucidly arranged, and apparently correct, of the relative strength of cast-iron guns in the ordinary state, and strengthened according to his system. On the question of cost we cannot quite agree with him; but there is much that is interesting to be found in the twenty-four pages of which the pamphlet consists. Mr. Parsons' observations on rifling appear sound in their general character; and as the subject now attracts so much attention, we recommend them to the attention of our readers.

ON THE EXPANSIVE ENERGY OF HEATED WATER.*

By W. J. MACQUORN RANKINE.

As the question of the quantity of mechanical energy which a given weight of water, heated to a given temperature, is capable of exerting in the act of partially evaporating without receiving heat, until it falls to a given lower temperature, has been raised in connection with recent researches as to the bursting of steam boilers, I may point out, that the complete solution of that question for any given liquid, together with a numerical example in the case of water, is given under the head of "Proposition XVII." of a Paper on "Thermo-dynamics," which was communicated by me to the Royal Society in December, 1853, read in January, 1854, and published in the "Philosophical Transactions for 1854."

That solution is expressed by the following formula (page 161, Equation 65):—

Energy exerted by each pound of fluid

$$= K \left\{ t_1 - t_2 \left(1 + \text{hyp. log. } \frac{t_1}{t_2}\right) \right\}; \ \ldots\ldots \ (1.)$$

in which K denotes the dynamical value of the specific heat of the liquid, being the product of its specific heat expressed in the ordinary way by "Joule's Equivalent":—

t_1 and t_2 the initial and final absolute temperatures; the absolute zero being 274 deg. Cent. or 493·2 deg. Fahr. below the melting-point of ice.†

Another equation (Equation 63 of the Paper) gives the following value for the excess of the final volume to which the mixed liquid and vapour expand, above the original volume of the liquid:—

$$\frac{K \text{ hyp. log. } \frac{t_1}{t_2}}{\frac{dp_2}{dt_2}}; \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (2.)$$

in which $\frac{dp_2}{dt_2}$ denotes the rate at which the pressure, in lbs. on the square foot, varies with temperature, at the final temperature.

When applied to the water in a steam boiler, these equations take the following form:—

The value of K for liquid water is—

772 foot-pounds per degree of Fahr. in a pound of water, or

1389·6 foot-pounds per centigrade degree in a pound of water, or

423·55 kilogrammetres per centigrade degree in a kilogramme of water.

The final absolute temperature is 212 deg. Fahr. + 461·2 deg. = 673·2 deg. Fahr.

The corresponding value of $\frac{dp}{dt}$, for Fahrenheit's scale and British measures, is 42; and $772 \div 42 = 18{\cdot}38$.

Let T denote the initial temperature on Fahrenheit's ordinary scale; so that $t_2 = T + 461{\cdot}2$ deg.

Then—

Energy, in foot-pounds, exerted by each pound of water

$$= 772 \left\{ T - 212^\circ - 673{\cdot}2^\circ \text{ hyp. log.} \left(\frac{T + 461{\cdot}2^\circ}{673{\cdot}2^\circ}\right) \right\}; ^{*} (3.)$$

Final volume of expansion of mixed water and steam in cubic feet per pound

$$= 18{\cdot}38 \text{ hyp. log. } \left\{ \frac{T + 461{\cdot}2}{673{\cdot}2^\circ} \right\} \ \ldots\ldots\ldots\ldots \ (4.)$$

It is worthy of remark, that *the energy developed depends solely on the specific heat of the substance in the liquid state, and the initial and final temperatures*, and not on any other physical property of the substance.

The following table gives some results of the formulæ:—

The first column contains the temperature on the ordinary scale of Fahr., with intervals of 36 deg. Fahr. = 20 deg. Cent.

The second column contains the expansive energy of 1 lb. of water, in foot-pounds.

The third column contains the velocity, in feet per second, which that energy would impress on a projectile of the weight of the water itself; that is, 1 lb.

The fourth column, the final volume of expansion of the water and steam, in cubic feet per lb.

For convenience, a fifth column is added, containing the initial absolute or total pressures in lbs. on the square inch.

The last line of the table has reference to the case in which the water would be totally evaporated.

TABLE I.

Initial Temp. Fahr. deg.	Energy, foot-lbs.	Velocity, feet per second.	Final Expansion, cubic feet.	Initial absolute pressure. lb. per sq. in.
212 ...	0 ...	0 ...	0 ...	14·70
248 ...	726 ...	214 ...	0·95 ...	28·83
284 ...	2,779 ...	428 ...	1·87 ...	52·52
320 ...	6,052 ...	624 ...	2·73 ...	89·86
356 ...	10,422 ...	819 ..	3·56 ...	145·8
392 ...	15,826 ...	1,010 ...	4·36 ...	225·9
428 ...	22,156 ...	1,194 ...	5·11 ...	336·3
...	...	...	...	...
about 2,360 ...	about 912,500 ...	about 7,666 ...	26·36 ...	unknown

In the absence of logarithmic tables, the following approximate formulæ may be used for temperatures not exceeding 428 deg.

$$\text{Energy, nearly} = \frac{772\,(T - 212^\circ)^2}{T + 1{,}134{\cdot}4^\circ}; \ \ldots\ldots\ldots\ldots \ (5.)$$

$$\text{Expansion, nearly} = \frac{36{\cdot}76\,(T - 212^\circ)}{T + 1{,}134{\cdot}4^\circ} \ \ldots\ldots\ldots \ (6.)$$

Glasgow, October 5, 1863.

Note added October 19, 1863:—

In explanation of the formulæ and tables it may be added, that the mechanical energy in column 2 is the equivalent of the heat which disappears during the process, being the difference between the whole heat expended and the latent heat of that portion of the water which at the end of the process is in the condition of steam at atmospheric pressure.

For the information of those who consider that the liquid portion of the water, owing to its small compressibility, acts like a volley of hard projectiles, a table is added, showing, for each of the initial temperatures in the previous table, what fraction of a pound of water continues in the liquid state, and how much of the energy developed is possessed by that liquid water.

TABLE II.

Initial Temperature Fahr. deg.	Proportion of the water which remains liquid. lbs.	Energy possessed by that liquid water. foot-lbs.
212	1·000	0
248	0·964	700
284	0·931	2,587
320	0·897	5,429
356	0·865	9,015
392	0·835	13,215
428	0·806	17,858
...	...	...
about 2,360	0	0

In the formulæ and tables, it has not been considered necessary to take into account the small increase which the specific heat of water undergoes as the temperature rises.

W. J. M. R.

* Read at the Institution of Engineers in Scotland.

† In the original Paper, the absolute zero of heat was assumed to be 272½ deg. Cent. below the melting-point of ice. The value now adopted, 274 deg. Cent., is deduced from later experimental data.

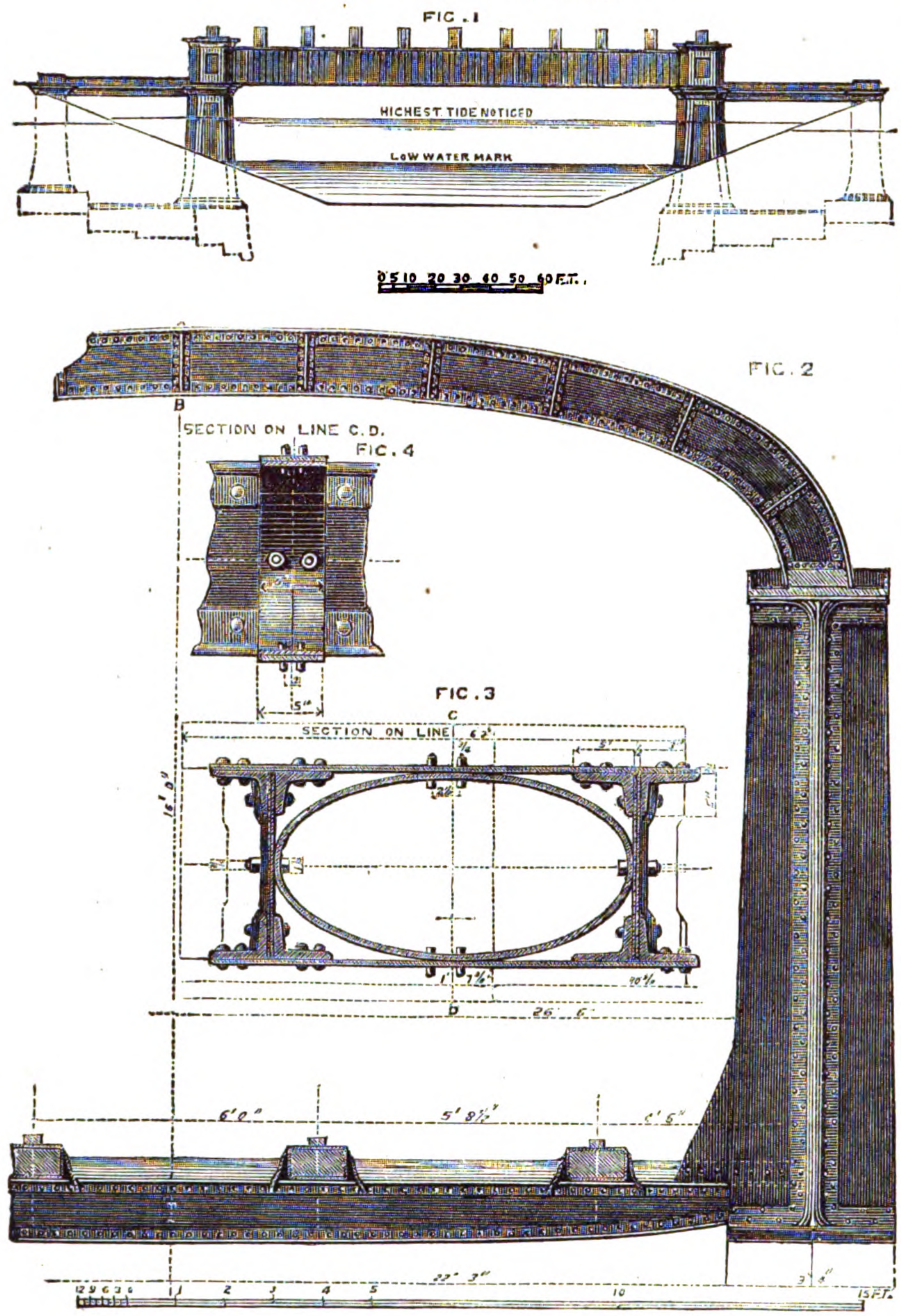
* This agrees with the formula given by J. B. in the *Engineer* of the 2d October, 1863, page 200.

THE CHRONOTHERMAL STOVE.

MESSRS. LUCK, KENT, and CUMMINGS, of Regent-street, Waterloo-place, have recently brought out a stove, which is distinguished by the simplicity of its construction, and the admirable manner in which it effects the purpose it is intended to fulfil. It consists of a cylinder of cast iron, about 20 in. long and 9 in. in diameter, pierced with several apertures at each end. This, which forms the external portion of the stove, is mounted on an ornamental base, fitted with a sliding register for regulating the draft through the fire, and surmounted by a suitable lid or top, of handsome design. An internal cylinder, one or two inches smaller than the external case, within which it is suspended, contains the circular grate on which the fuel rests. The fire, kindled at top, heats the metal with which it is in contact nearly red hot. The air contained in the space between the two cylinders is rarefied, and flows out into the apartment through the holes in the upper portion of the external case, while cold air rushes in through those beneath to make up the deficiency. The passage of the air over the heated plates is so rapid that the particles of dust in suspension cannot become ignited, and there is in consequence a complete absence of that peculiar scorched odour, so common in rooms heated by the ordinary stove. The products of combustion are conveyed away by a small pipe proceeding from the side of the stove into any convenient flue. The calorific powers of the apparatus are very considerable, 12 lbs. of Welsh coal, sufficing to warm a large hall for an equal number of hours. The fire, once ignited, requires no further attention whatever during the day. When burned out, the inner cylinder is withdrawn by a suitable hook, and another filled with fresh fuel substituted, so that the operations of the stove can go on uninterruptedly for weeks together if necessary. From what we have seen of its powers, we feel no hesitation in pronouncing the chronothermal stove one of the best things of the kind before the public.

Captain Kirkham, of the bark "Edwin and Lizzie," who has just arrived in the Mersey, gives particulars of one of those rare instances of a whale striking a vessel direct on the stem, and which in the case of his ship nearly caused her to founder, so tremendous was the shock she received. The "Edwin and Lizzie" left Prince Edward Island with a cargo of timber, and on the 12th of October, in lat. 45.1 N., long. 27.8 W., at half-past one in the afternoon, was struck by a large whale. Part of her cut-water was carried away, and the main stem cut right through to the wooden ends. This terrible blow, as might be expected, caused great alarm on board the vessel, and so rapidly did she leak that the pumps were instantly manned, and kept going night and day without intermission. Fortunately, they were equal to the emergency, and though the "Edwin and Lizzie" (a new vessel) had 7 ft. of water in her hold, she was brought safely to the Mersey and docked.

THE PIALLEE BRIDGE, INDIA.



THE PIALLEE BRIDGE, INDIA.

THE Piallee bridge, which is of the plate girder construction, crosses the Piallee River, India, with one span of not less than 170 ft. between the abutments. It is single, the double line of rails being borne by one pair of girders, as shown in fig. 2, which have a depth of 13½ ft., and are stiffened on the upper edge by a cast-iron flange. This is the only case in India in which cast iron has been thus combined with wrought-iron girders. The different ratio of expansion of the two materials would probably be fatal to the general adoption of mixed structures, the stability of which might be endangered in places where the range of temperature is great and changes rapid—as for instance, in the Punjab and the Upper Provinces. In Bengal, however, where the range of the thermometer is not much greater than in England, and the humidity of the atmosphere checks rapid radiation, this objection is of less force. The great depth of the girders has necessitated the adoption of some contrivance to prevent buckling, and accordingly they are connected at intervals of 19 ft. by elliptical arched ties of boiler plate, arranged in pairs and stiffened, as shown in figs. 3, 4. The width of the roadway between the girders is 22 ft. 3 in.

The bridge was designed by Mr. J. A. Longridge, and erected under the superintendence of Mr. J. Sturmer, the resident engineer of that part of the line.

At the point at which the bridge crosses the Piallee, the river flows in an artificial channel. It formerly made a bend at this point, which carried the stream about 400 ft. to the west of its present course, and it thus became necessary to carry the embankment, which forms the western approach of the bridge, across the old channel, the bottom of which was 60 ft. below high-water mark, and 83 ft. below the level of the line. Accordingly, in July last year, the new cut having been excavated, and the lower end of the bend bunded with sand-bags to facilitate silting, the embankment was commenced by throwing in earth from the western bank. The soil of the locality, like that of the Sunderbunds generally, however, is a soft loam, highly absorptive in water, so that the earth thrown in speedily formed a semi-fluid slush, which flowed out on both sides, filling up the old channel, and then flowing out at one or both ends into the river. No efforts could succeed in raising the embankment above the level of high-water, and a quantity of bamboos which were laid down with a view to impede the lateral motion of the earth, after settling together with the embankment, reappeared after a few weeks some 200 ft. off on the line of outflow. At length, in February of the current year, finding that there was no hope of the earth attaining sufficient solidity to bear the weight of the embankment as hitherto attempted, Mr. Wall adopted the expedient of constructing a great float, on the same elementary principle, although differently applied in construction, as that adopted with so much success by George Stephenson at the Chat Moss.

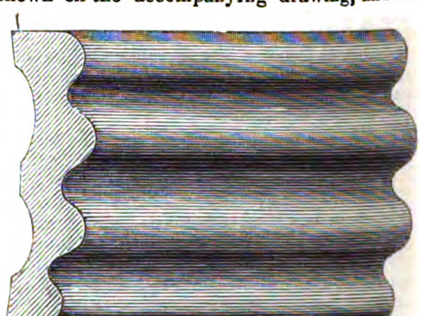
Two rows of piles, 100 ft. apart, were driven in along the sides of the proposed embankment across the old channel, and the earth having been excavated to a depth of 3 ft. or 4 ft., the base of the excavation was floored with palm trees laid longitudinally, and bonded together with hoop iron, the extremities of which were carried round the piles, and thus a flexible box was formed on which the embankment was to be raised. The upper and lower ends of the piles were also tied together with those of the opposite row with hoop iron. Upon the structure thus formed the earth was then thrown. The float yielded slightly under the pressure, but beyond this stood firm, and the embankment was speedily carried up to the required height of 20 ft. above high-water level. Thus at length a difficulty has been overcome which at one time threatened to render the actual line impracticable, or to involve the alternative of necessitating a second bridge of equal dimensions to that crossing the cut. Not less than 4,000,000 cubic feet of earth were expended on this work or about four times the amount theoretically required for an embankment on the same dimensions, had the materials been of a stable character.

GRAY'S IMPROVEMENTS IN BEATERS FOR THRASHING MACHINES.

MR. W. GRAY, machine knife manufacturer, Sheffield, has recently patented the following improvement in beaters for thrashing machines.

The revolving beater or drum in ordinary thrashing machines consists of several longitudinal bars firmly secured and attached to arms or spokes, or to the periphery of wheels affixed to a central shaft or axis with which the beater or drum revolves.

This invention consists, firstly, of the rolling of steel of any description, or wrought iron in the shape or design, or any similar shape or design, shown on the accompanying drawing, and the



application of such rolled steel or wrought-iron bars to be used or applied as beaters for thrashing machines on the drum, concave, or breast plate. The patentee does not confine himself to the precise shape as shown on the drawing, as the same may be altered or modified as circumstances may require; these beaters, made of steel or wrought iron, being superior and more durable than those now generally used.

Secondly, this invention consists of fluting or grooving in steel or wrought iron the surfaces of

the longitudinal bars of the beater in the manner shown on the drawing, in perspective, by which the shape or design is clearly shown, the parts grooved or hollowed out underneath being merely for the purpose of reducing the weight.

TRIAL OF HER MAJESTY'S SCREW LAUNCH "EXPERIMENT."

The official trial of this little craft, which has been fitted by the steam factory department of Portsmouth dockyard expressly, by order of the Admiralty, in order to obtain certain data relative to the merits of the double or twin screw system, took place on Monday in Stokes Bay.

The "Experiment" is a first-class line-of-battle ship's launch, 42ft. in length, and of proportionate breadth and depth. Her engines and boilers occupy a space in the centre of the boat of only 6ft. 11in. by 4ft. 4in., the nominal horse power of the engines being 3, the length of the stroke of piston 6in., and the diameter of cylinder 4in. The total weight of engines and boilers, with platform, coal-boxes, &c., and with boilers fitted, is 2¼ tons. The cylinders are brought on to each side of the boiler and drive their independent shafting through each quarter with screws attached to the latter of four blades, each screw having a diameter of 2ft., and a pitch of 3ft. 4½in. The draught of water of the launch, at the commencement of the trial, was 2ft. 6in. aft, and 1ft. 9in. forward. The launch steamed out of the harbour at 10 a.m. against a strong flood tide, and excited considerable surprise in the minds of those on board by the manner in which she ran over the strong adverse tide. The measured mile was reached, and the little vessel was at once placed upon her speed trials, which she accomplished as follows :—

	Time. m.	Time. s.	Knots.	Pressure of Steam. lbs.	Rev. of Engines.
First run ...	8	3	7·453	55 to 50	290
Second run	10	57	5·479	55 to 50	280
Third run...	7	15	8·275	60 to 55	200
Fourth run	11	28	5·232	60 to 55	280
Fifth run...	7	19	8·200	60 to 58	290
Sixth run...	11	10	5·373	59 to 55	280

Mean speed of the six runs, 6·742 knots.

The revolutions of the engines averaged 290 at 60 lbs. pressure of steam, and with that pressure the experiment will realize a good seven knots. On Monday, from a cause which can be easily remedied in future, the steam, as will be seen by the foregoing figures, could not be kept at 60 lbs., and consequently the vessel lost in speed, although it was almost impossible for anything to be more satisfactory than the speed she actually attained. Indeed, it has become a question worth noticing, while referring to speed alone, whether by thus dividing the propelling power of a vessel in the substitution of two for a single screw, an additional speed of the ship through the water is not gained. The advocates of the principle, such men as Commanders Symonds and Selwyn, R.N., say that full 20 per cent. is gained. Reverting, however, to the actual results obtained by the trial of the "Experiment," on the conclusion of the speed trials the vessel was next tested in making circles as follows :—With both engines going ahead at full speed, with the rudder acting, a complete circle was made to starboard in 1 min. 9 sec., and to port in 1 min. 13 sec. The circle was next made with one engine shut off, and with the port engine standing (the helm still being brought into use) a circle was made in 1 min. 31 sec., and with the starboard engine shut off in 1 min. 27 sec. Reversing the motion of the respective engines, and with the starboard engine going ahead and the port astern, the circle was made in 2 min. 9 sec. Repeating this experiment, but with the starboard engine astern and port ahead, the circle was made in 1 min. 43 sec. The diameter of the circles made, as near as could be ascertained without actual measurement, was, with both engines going ahead and rudder acting, rather under three times the length of the launch ; with one engine shut off, rather over that distance ; with engines reversed, and screws, therefore, working opposite ways, the launch turned on a pivot just abaft her centre, and within her own length, gradually working spirally and astern. The foregoing results confirm in a remarkable degree the trials made during the past 12 months on the Thames, by Messrs. Dudgeon, of Limehouse, which have attracted so much attention in the naval and scientific world, and which have been attended and officially reported upon for the information of the Admiralty by their inspecting engineer afloat, Mr. John Dinnen.

TABLES RELATING TO LOCOMOTIVE ENGINES.

We copy the following useful tables from the *American Railway Times*. They should find a place in the engineer's note book :—

The tractive power required to move any load upon a level railway is found by dividing the square of the speed in miles per hour by 171, and to the quotient adding 8, and multiplying the sum by the load in tons.

Speed in Miles per hour.	Tractive power needed, load being 50 tons.	75 tons.	100 tons.	250 tons.
12	442	663	884	2210
15	465	691	931	2328
20	517	773	1034	2585
25	582	874	1165	2912
30	663	994	1326	3315

Table showing the tractive power required to overcome grades with different loads.

Grade in feet per mile.	Load in tons. 1.	50.	75.	100.	250.
20	8	424	636	848	2122
40	16	848	1272	1696	4244
60	26	1272	1910	2546	6340
80	33	1697	2545	3393	8489

To find the tractive power needed to overcome any grade, we multiply the load by the rise per mile, and divide the product by 5280, the number of feet in a mile.

Table of factors which multiplied by the total piston pressure give the tractive power of the engine in lbs.

Diameter of Driver.	Stroke in inches. 18.	20.	22.	24.
4	2386	2652	2918	3182
4¼	2250	2500	2750	3000
4½	2151	2390	2593	2830
4¾	2012	2235	2459	2682
5	1910	2122	2334	2546
5½	1736	1929	2122	2315
6	1591	1768	1945	2122

The above are all decimals, and are got by dividing the double stroke by the wheel circumference, both in inches.

Table of piston pressures for different cylinders, and different steam pressures.

Diameter of Cylinder.	Area of Piston.	Whole pressure on both pistons, at 100 lbs.	110 lbs.	120 lbs.	130 lbs.
16	201	40,220	44,242	48,264	52,062
18	254	50,900	55,990	61,080	66,170
20	314	62,840	69,124	75,408	81,692

Relative volumes of steam under different pressures.

Steam pressure.	Relative volume.	Steam pressure.	Relative volume.
80	359	120	249
90	323	130	231
100	293	140	216
110	269	150	203

That is, at a pressure of 100 lbs. per inch, each cubic foot of water will make 293 cubic feet of steam.

Table giving the amount of surface obtained by 100 tubes, of different dimensions.

Length of tube in feet.	Square feet of surface in 100 tubes, diameter of tubes in inches being 1½.	1¾.	2.	2¼.	2½.
10.0	392	457	524	589	655
10.5	411	480	549	618	687
11.0	431	503	576	647	720
11.5	451	526	602	677	753
12.0	471	549	628	705	786

Table showing the mean pressure in the cylinder, for different percentages of admission, and different initial pressures.

Initial pressure in lbs.	Mean cylinder pressure cutting off at ¼.	⅓.	½.	⅔.	¾.
100	54	65	83	93	95
110	60	72	91	102	105
120	66	79	99	112	114
130	72	86	108	121	124

That is, if we cut off the steam at 50 per cent., which has a pressure at entering of 120 lbs. per inch, the mean pressure throughout the stroke will be 99 lbs.

PHOTOMETRICAL POWERS OF THE ELECTRIC LIGHT AT BOSTON.

The battery used consisted of 250 Bunsen elements, having each an acting zinc surface of about 85 in., and grouped in five battalions of 50 each, was arranged in the dome of the State House, and the carbon light and the photometric apparatus prepared for the purpose were placed in line across the same apartment, commanding a range of about 50 ft.

In view of the immense power of the light, as observed in the previous experiment, I substituted for the 20-candle gas burner, used at that time as the standard of comparison, a unit ten times as great, formed by the flame of a kerosene lamp placed in the focus of a small parabolic reflector, and throwing its concentrated light on a photometric screen of prepared paper fixed infront of it, at the distance of 5 ft. Before the observation, the lamp and reflector were so adjusted as to make the light cast on the near side of the screen equivalent by measure to the action of 200 candles.

This was done by the intervention of a kerosene lamp fitted up with a bridge of platinum wire for defining and restricting the height of the square flame. Such a lamp I find of frequent use in ordinary photometry, as, when suitably adjusted, it gives the light of about eight standard candles, and thus transfers the measurement in the photometer to the wider divisions of the scale. Being suspended in a balance of peculiar construction, its rate of consumption enables us to correct for any slight departure from the assigned illumination. The lamp thus regulated was placed with its flat flame 12 in. from the screen, while the lamp in the reflector was distant 60 in., and the flame of the latter was adjusted until the effects on the screen were equalized.

A platform supporting the standard lamp and screen at the assigned distance was arranged to slide on a horizontal graduated bar, extending directly towards the carbon points so that the screen should receive the rays from the electric light and from the reflector perpendicularly on its opposite faces. In making the observations, the platform was moved to and fro until the illumination on the opposite sides of the screen was judged to be equal, and then the measured distances of the two antagonizing lights from the screen gave, by easy computation, their relative illuminating power.

By a series of such observations, it was found that the carbon light had a force varying from 52 to 61 times that of the lamp with reflector, making it equivalent in illuminating power to the action of from 10,000 to 12,000 standard sperm candles pouring their light from the same distance upon the surface of the screen. This, it will be remembered, is the effect of the unaided carbon light sending its rays equally in all directions from the luminous centre, and falls vastly short of the illuminating force of the cone of collecting rays which was seen stretching, like the tail of a comet, from the surface of the great reflector. Judging from some recent experiments on the power of such a reflector to augment the intensity of the light emanating from its focus, there can be no doubt that, along the axes of the cone, when brought to its narrowest limits, the illuminating force of the carbon light, as displayed on the State House, could be rivalled only by that of several millions of candles shining unitedly along the same line.

In the above described observations a thick screen was necessary, on account of the great intensity of the lights to be antagonized. I need hardly say that the different colour of the two lights added much to the difficulty of the measurements. But, by marking in each case the extreme limits on either side, it was practicable to adjust the screen pretty accurately to equality of illumination.

The only previous experiment of precisely the same kind which I can recall is that of Bunsen, cited in the books, which was made with a battery of 48 elements. In this the photometric equivalent of the carbon light was estimated at 572 candles, or nearly 12 candles to the cell. My observations show a power more than three times as great, or about 40 candles to the cell—a difference due, no doubt, largely to the more intensive battery at my disposal, and the cumulative effect of its arrangement. I suspect, too, that the elements in Bunsen's observatson were of inferior size ; but on this point I am without definite information.—*Silliman's Journal.*

STEAM FRIGATE "NIAGARA."

The late George Steers, who was esteemed one of the most skilful modellers and constructors in the world of fast-sailing vessels, designed and built the frigate "Niagara," the largest in the American navy. Her model is held to be faultless for securing speed ; but with naval men she has never been a favourite, and under steam her speed has been only moderate. Her engines have been held to be deficient in power ; and for about a year past, when her services might have been most valuable on the southern coast, she has been laid up at the Charlestown (Mass.) navy yard, undergoing extensive repairs. Her old engines have been taken out and more powerful ones substituted ; and it is now expected that her speed will be greatly increased. The new armament of this frigate surpasses that of any other vessel in the world for weight of metal. It consists of twelve 200-pounder Parrot rifled guns on the spar deck, and twenty-four 11-inch smooth-bore guns for throwing hollow shot and shell on the main deck. The old system of arming war vessels was based upon furnishing them with the greatest number of guns possible; the modern method consists in supplying a much smaller number, but of much greater calibre.—*Scientific American.*

SYMONDS' SCREW SHIPS.

FIG. 1

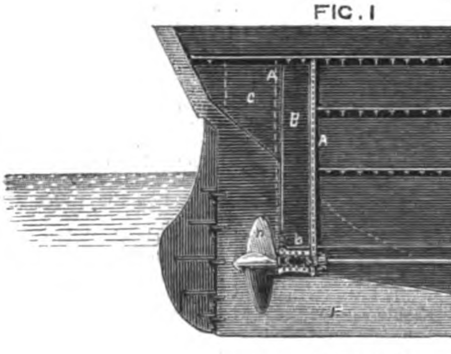


FIG. 2

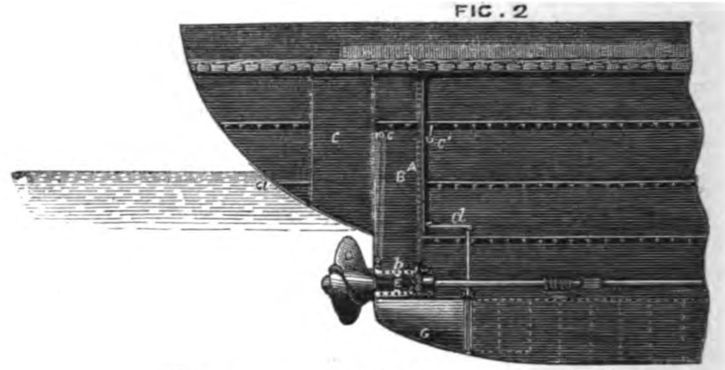


FIG. 3

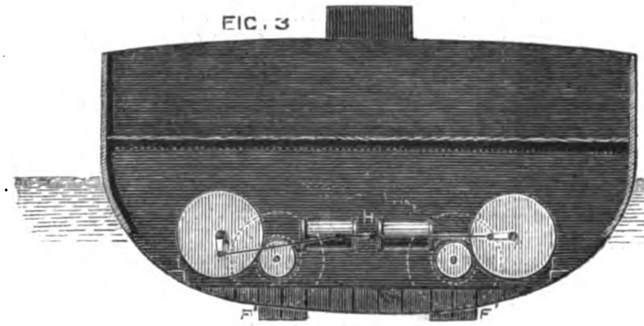
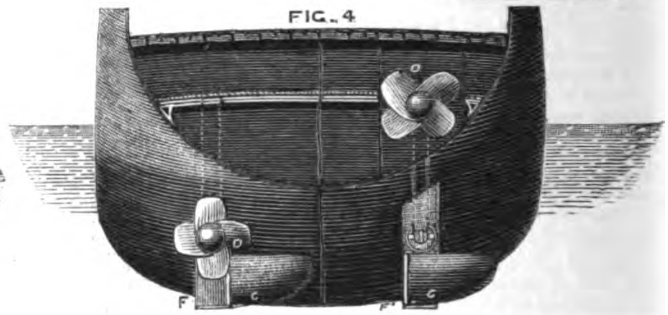


FIG. 4



SYMONDS' IMPROVEMENTS IN THE CONSTRUCTION OF SCREW SHIPS.

This invention, patented by Thomas E. Symonds, Commander R.N., relates to twin or double screw ships built of iron, and having one or more keels, each screw being overhung or having no outer bearing.

In constructing ships according to this invention, two transverse bulkheads are formed across the stern part of the ship, the aftermost of these bulkheads being immediately before the screw, and a well-hole for receiving each screw is also formed under the counter and abaft the transverse bulkhead.

For the purpose of enabling overhung screws, according to this invention, to be raised vertically, the patentee mounts or fixes each screw upon a short length of shaft, which is supported by and free to revolve in a long bearing formed by two half-carriages, which when brought together form a tube, which may be filled with lignum vitæ strips or other bearing and wearing surfaces. These half-frames when combined form the carriage, which, sliding in a vertical frame or guides between the transverse bulkheads, enables the screws to be raised vertically, so that the ship may sail without the obstruction offered by the screw propeller. Each screw may be raised separately. The inner end of the short shaft, upon which the screw is mounted, may be fitted with the ordinary form of cheese-head coupling. The withdrawing the screw from the water or the raising and lowering may be effected by means of chains or ropes and pulleys, or any of the well-known mechanical means may be adopted for that purpose. The foremost of the transverse bulkheads is fitted with a stuffing box for the screw shaft, and one part of the cheese-head coupling projects therefrom. The apertures for the screws are fitted with flaps or shutters opening outwards (or they may be made to slide), for the purpose of closing the opening at the bottom of the screw hole, so as to ensure a clear delivery of the water, whether under steam or sail. The overhanging end of the screw or one of the blades may have a hole cast or formed therein for the purpose of enabling the screw to be "fished," or to assist in withdrawing it or hauling it up.

For the purpose of withdrawing the overhanging screw horizontally from off the screw shaft in double screw vessels, the shaft is made at the outer end sufficiently large to enable it to be bored or otherwise made hollow, for the purpose of receiving the shank of the screw, or a short length of shaft upon which the screw has been fitted, and by means of a gib and cotter passing through slots formed in both the screw shank or shaft and the hollow part of the main shaft within or forward of the stuffing box, or between the outer and inner bulkheads, or forward of the stern bearing, thus the key or other means of securing the overhanging screw in its place may be withdrawn and the screw released.

By the arrangement of bulkheads forming the after termination of the hull in the manner described, the patentee is enabled to give additional strength to the ship as a structure; and by the arrangement and disposition of the stern part externally and of the rudders in double-keeled vessels, to avoid the necessity for any after stern-post, upright, or framing piece abaft the screw propeller, or any opening or void, such as exists in ships of war and other vessels, between the fore and after stern-posts, which impairs the steering qualities of the ship.

In iron screw vessels having double keels a rudder is placed in the line of each keel, and nearly in a line with each screw shaft, and the tillers connected together so as to enable them to work simultaneously, but they may be readily disconnected for the purpose of being worked separately.

In the accompanying drawing, fig. 1 is a side elevation of the stern part of a ship of war of the same dimensions as the "Warrior," constructed according to the present invention, showing the arrangement of transverse bulkheads, the arrangement for lifting the screw, and the trunk or well-hole for each screw; this vessel has two screws and a single keel and rudder. Fig. 2 is a longitudinal section, and fig. 4 an elevational stern view in two sections of a double-keel iron ship having two screws and two rudders fitted according to this invention in a ship of large size suited for war purposes.

In the two sectional views in fig. 4 the one is so taken as to show the screw in its usual position, and also the trunk or space up which the screw shaft travels; the other section shows the screw raised, the screw well-hole, and the cheese-head coupling or bearing in the trunk or box projection which springs from the keel for the purpose of receiving the outer length or screw shaft:

Fig. 3 is a transverse section, showing an arrangement of engines for driving the two screws independently, to admit of manœuvring the vessel with or without the aid of the rudders; and although in this section a peculiar arrangement of engine is shown, in which it is intended to employ two pairs of engines (each of two cylinders), and wheel gearing is also intended to be employed for allowing of the engines working slow. The patentee does not confine himself to this arrangement.

In the several figures, A is the transverse bulk-head hereinbefore referred to in the stern portion of the hull, and which is in every case carried up above the deep load line, and in vessels of light draft it is proposed to carry it up to the deck line in screw ships where the screw is raised vertically; B is the narrow trunk or space in which, in double-screw ships having overhung screws, the short shaft and the main bearing are made to slide or travel up and down as shown; C, the well-hole, in which the screw is raised and withdrawn when out of use from its working position; D, the screw, which may be varied in form; E, the shaft upon which the screw is mounted, and which shaft may be fitted and moved and detached from the screw in either of the manners hereinbefore described, and in each case the mode or method of fixing the screws, and of connecting the short shaft to the main shaft, and the mode of lifting or moving it, as also of connecting and disconnecting the screw, is shown in accordance with this invention; F, the keel of the single-keel double-screw ship, and F^1, F^1, the keels of double-keel ships; G, G, the rudders of double-keel double-screw ships, the mode of working these rudders being shown; H, an arrangement of horizontal engines and gearing for driving the two screws, which may or may not be adopted; a, a, are flaps for closing the screw well-hole, and b, the long bearing and carriage containing the short length of screw shaft, and which is fitted so as to slide vertically into and out of gear with the cheese-head coupling on the screw shaft; c and c^1 are the pulleys or sheaves for lifting and lowering the screw; d, the tiller of the rudder; e, the thrust block of the screw shaft.

WILSON AND SMITH'S IMP[ROVEMENTS] IN FURNACE GRAT[ES]

This invention, patented by Mes[srs. ... Wil]son, engineer, and J. Smith, bake[r, ...] relates to a novel arrangement of ... ing furnace fire-grates, and consis[ts ...]

...rawing, ... as circu... made of st... more dura... of fluting ... the surfaces ...

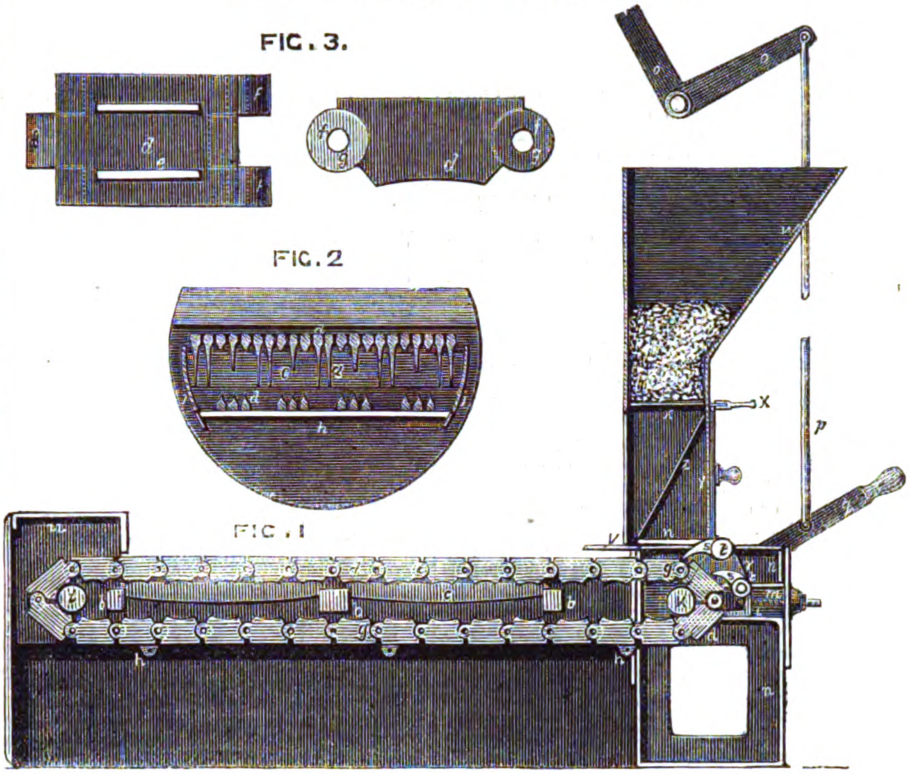
employment of stationary bars and travelling bars, placed alternateley to form the suport for the fuel, and such bars, when so arranged, may be distributed either lengthwise or across the furnace.

The stationary bars are of the usual kind, and rest on bearers as at present. The travelling bars are made of short links or short bars jointed at suitable distances apart so that they form an endless chain, and for this reason they are termed "chain bars." At either end of the furnace fire-grate, or at the sides should the bars be placed transversely, the chain bars are carried by and pass around a drum or shaft, from the surface or surfaces of which are a number of projecting arms or tappets to fit into or between the links of each separate endless chain of bars. Motion is communicated to the drum or shaft in any convenient manner from any available source, so that when in use one-half of the chain bars of each endless chain will be moving immediately in contact with the fire and the other half in the ashpit. In some cases the patentees employ under the surfaces of the chain bars, in contact with the fire, and parallel with the stationary bars, so that they may rest on the same bearers, smaller stationary bars to keep the chain bars from "sagging," and to maintain them in a uniform position in relation to the stationary bars. Instead, however, of the chain bars travelling continuously from end to end or from side to side in one direction by a rotary motion, they may have communicated to them by cams, or any other well-known change gear attached to the drum or shaft, a reciprocating or an intermittent motion so that they may travel any desired length in one direction and as far or a shorter distance or length back again, or they may travel a short distance, then stop, and so on alternately.

Fig. 1 of the accompanying drawing is a longitudinal section (taken through between the stationary and travelling bars and looking on the chain bars); and fig. 2 a transverse section; the arrangement being such that the motion given to the chain bars is a forward one for a short distance, after which they are allowed to stop, and so on, moving and stopping alternately. Like letters designate the same parts in all the views.

a represents the stationary bars, shown of the usual shape, in two lengths, and resting on cross bearers *b*, all of which, with the exception of those at the ends, are notched and recessed to allow the stationary bars to pass through, and the carrying bars *c*, to prevent the chain bars *d* from "sagging," to rest thereon. The chain bars *d* are made of a good width and with air apertures *e* therethrough. At the under side, the projecting pieces *f* (see enlarged view, fig. 3) fit into each other, and are coupled by pins or bolts *g*, preferably, with the heads rivetted down, thus forming articulated bars; *h* shows transverse rollers for supporting the chain bars underneath; *i*, the back chain bars supporting roller, at freedom to rotate in its bearings which are part of the framework *j*; *k*, the front supporting shaft resting in two screw sliding nuts *l*, so that by the screws *m* passing through the front framework *n*, the chain bars may be tightened or slackened at pleasure. Motion is communicated through or by the bell crank *o*, connecting rod *p*, and lever *q*, secured on or to the front supporting shaft *k*, at the rate of about two double (that is up and down) strokes a minute. Crank brackets (shown only in fig. 1) to every chain of bars, or two large crank brackets, one at either side, are secured to the shaft or drum *k*. These crank brackets *r* carry for each chain of bars two impulse pallets *s* jointed on pins *t*, or on rods passing from one side to the other, and the motion above referred to, which is reciprocating, should preferably give a throw sufficient to enable the pallets *s* to move the chain bars half a link each stroke; *u*, a guard of metal or fire-brick to prevent the fuel from being carried over the back of the fire-grate; *v*, the dead plate; *w* shows a hopper with supply control slide *x*, door *y*, and coal guide *z*, which latter can be slid upwards into the hopper out of the way when the "firing" is done by hand; but as there is nothing new in the hopper or its immediate connections, it need not be further described.

WILSON AND SMITH'S FURNACE GRATES.



YATES' IMPROVEMENTS IN THE MANUFACTURE OF ARMOUR PLATES.

THIS invention, patented by Mr. T. Yates, Rotherham, ironmaster, has for its object improvements in the manufacture of large and heavy armour plates or blocks and bars suitable for the protection of fixed and floating forts or batteries, whereby economy of labour is obtained and a stronger and cheaper armour plate or block is produced.

According to the present mode of manufacturing armour plates they are rolled or hammered generally to a uniform thickness or nearly so, or to an even taper or nearly so, the edges of the plate being rough and uneven, and requiring to be afterwards cut off or trimmed in order to square up the plate, which operation is both costly and wasteful.

According to these improvements, the operation last referred to is, for the most part, dispensed with, the plate being rolled or hammered with smooth edges, and therefore requiring little or no further trimming or cutting. For this purpose it is proposed to hammer, stamp, or roll the plates, blocks, or bars from the metal of which the armour plate or block is to be manufactured in metal moulds or frames, which impart the desired size and shape or nearly so to the armour plates or blocks, the sides of the mould or frame confining the material and preventing it from spreading whilst under the influence of the hammer or rolls beyond the size required, and leaving the edges of the plate or block, comparatively speaking, even and smooth. During the process of hammering or rolling the plate (and more particularly in the hammering) the necessary indentations or projections required for uniting, fastening, or attaching the plates may be formed.

In some cases where very strong re-

YATES' ARMOUR PLATES.

FIG. 1.

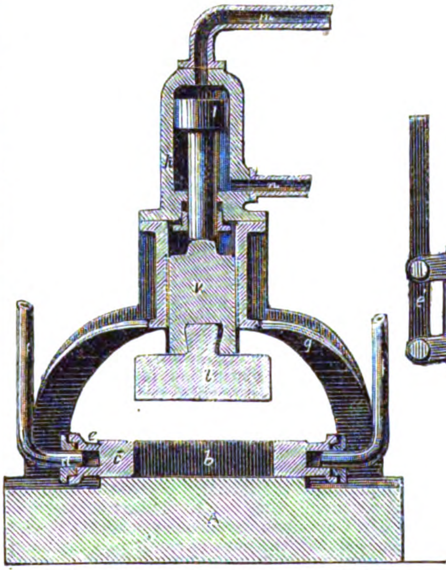
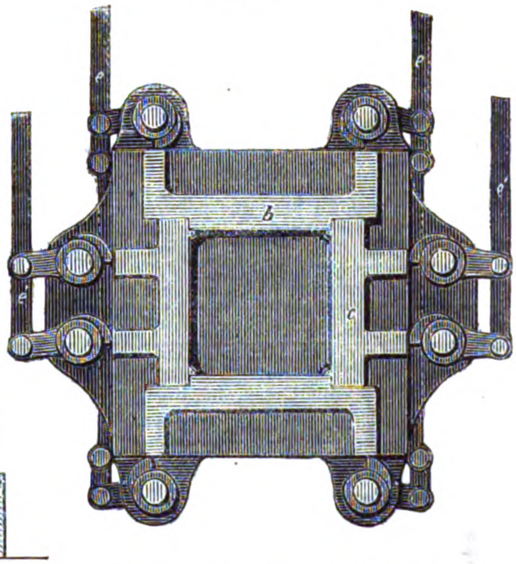


FIG. 2.



power is required, it is proposed to cast on to the plates made as above described a block or backing of cast iron or other suitable metal, the wrought-iron plate being either in a cold or hot state (but it is preferred to have it hot, so that the two metals will amalgamate), and placed in a suitable mould of the proper depth and form according to the desired thickness and shape of backing to be cast on the plate. This mould may be made either plain or with indentations or projections on the sides to facilitate the locking together of the plates or blocks, or the cast metal block may be prepared first and provided with projections or indentations upon that surface which is afterwards to be brought in contact with the wrought-iron plate, and the wrought-iron plate is then hammered or stamped upon it whilst in a soft or plastic state, and is thereby forced into and around the indentations or projections in the cast metal block so as to secure the two metals in close contact.

Fig. 1 represents a vertical section of one arrangement of machinery for stamping and shaping armour plates or blocks in moulds or frames by the aid of hydrostatic or hydraulic power. In this machine a perpendicular as well as a lateral or oblique pressure is applied to the plate or block by special and separate hydrostatic or hydraulic presses and rams, which, by their conjoint action, reduce the rough block to the desired shape and dimensions without the necessity of trimming the edges of the plate or block after it has been forged, excepting where very fine joining is required.

A is the anvil block, upon which slide horizontally in proper grooves or guiding slots the four lateral blocks *b*, *b*, and *c*, *c*, impelled by separate cylinders and rams *d* of their own; *f*, *f*, represent the pipes leading to the several hydrostatic or hydraulic cylinders; *q*, *q*, are the moulding surfaces which give the desired form to the edges of the blocks and which enclose the rectangular or other shaped cavity or mould *p*, in which the plate or block is deposited direct from the carriage or truck, as hereinbefore described. The upper frame *g*, *g*, is secured by bolts and keys to the anvil block, and carries the vertical cylinder *h*, ram *i*, and slide block *k*, which latter carries and guides the hammer *l*; *m* is the pipe which supplies the main cylinder *h*; two or more of such cylinders may be employed when large plates or blocks are to be stamped; *n* is the escape and back lift pipe. In working the press, the metal is placed in the mould or enclosed space *p* whilst in a plastic state, and the two opposite side blocks *b*, *b*, are then simultaneously pressed up to the ends of the blocks *c*, *c*. The side blocks *c*, *c*, are then immediately and simultaneously pressed home, thus completing the pressure upon all the sides of the plates and shaping those sides to the desired form. The large hammer *l* is then brought down upon the entire mass, finally reducing the metal to the form and thickness required. On removing the stamped plate or block it will be found when cool ready to be secured in its place after a very slight dressing of the edges.

Fig. 2 represents in plan a modified arrangement of mechanism for actuating the side blocks *b*, *b*, and *c*, *c*, a series of reciprocating cam levers *e*, *e*, and e_1, e^1, being employed in lieu of hydrostatic pressure. The main perpendicular stamper or hammer may, however, be worked either by hydrostatic or direct steam pressure.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—You have before now published an invention or two of mine, but under a different name. I have now one concerning balloons which I shall make public, so soon as I have completed the calculations. In order to complete them I require information on one or two minor matters. If you, or any of your correspondents, can give me this information, or Mr. Coxwell's address, I should be much obliged. I think I can give a clearer circumstantial account of the accident at Basford-park (I was on the spot) than has yet been given. My invention is quite a new idea, and will quite do away, I think, with all accidents arising from the valves. The following are the points of information I require:—

1. The weight of the top valve, name or kind of valve.
2. The same particulars with regard to the bottom valve.
3. Weight per yard super. of the silk.
4. Is it not customary only to fill the balloon, just so as to rise, or much more than enough?

I should be much obliged if you could enlighten me, and am, obediently yours, Alfred Edwin, C.E.

27, Castle-street, Dover, Kent.

E. A. Cartar.—Your invention is ingenious. We may perhaps illustrate it in a future number.

C. Y. (Nottingham).—The length of a safety valve lever is usually so proportioned that the effective pressure on each square inch of the valve equals the force of the spring balance. Thus, a valve with an area of 6 square in. should have a lever giving 6 to 1.

F. C.—The area of grate must depend on the quality of the coal which you use. Try 80 square in. per nominal horse-power, Glasgow rule.

Seaman.—Illustrated this week.

Received.—S. S.—J. D.—G. C.—A. E.—Messrs. McN. and Co.—J. N.—J. H.—L. E. E.—W. R.

Correspondence.

THE RIFLING PRINCIPLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Mr. Cheverton's scientific eccentricities are so well known to the generality of your readers, it would not be worth while noticing his theoretic *fancies* on gunnery, if his observations did not afford the opportunity of saying a word on precision of language—an object essential to fair discussion, but one on which that gentleman has very confused ideas. He delights in verbal criticism, the most irksome and unprofitable kind of literature, which usually has no other foundation than the critic's misapprehension or misrepresentation of a writer's meaning.

The same words often have or are used with different meanings. With scientific terms, in the use of which there is much uncertainty and affectation, this is peculiarly the case. Many violent controversies owe their origin to the different sense in which words are interpreted. The best rule is to employ them in the sense of their obvious and popular meaning.

According to Johnson, "momentum" is the "force *or* quantity of motion in a moving body." Here, then, we have two meanings. I prefer the former—*the force in a moving body*—consisting of velocity and weight combined; and this is the common acceptation of the word. The latter meaning—*the quantity of motion*—refers to velocity only. Mr. Cheverton confounds the two, hence his misapprehension of a plain statement. In a few words, I will set him right. By momentum, I mean the force of the moving body, as represented theoretically by the square of the velocity multiplied by the weight. I say that velocity and weight are the elements which constitute that force, and by way of illustration, and to keep in the mind of the reader the characteristics of the two elements, I call velocity the "vis viva," because it is *active*, and I call weight the "vis inertiæ," because it is *passive*. The distinction is intelligible, obvious, and convenient, and this distinction is so important, as applied to the effect of rifled projectiles, that I am glad I provoked Mr. Cheverton to bring the subject prominently forward.

Equal quantities of momentum, the products by calculation of varying quantities of velocity and weight, ought *theoretically* to give the same results, but *practically* they don't. This is not my *opinion*, as Mr. Cheverton erroneously asserts; it is, as I clearly stated, the *positive result* of experiments at Shoeburyness. I am sorry for the theory, but it shares the fate of the theories of the sages of Laputa—it is thwarted by disturbing causes, never dreamt of in their or Mr. Cheverton's philosophy. That gentleman's ardour in support of a principle reminds one of the enthusiastic French republican, who exclaimed, "Let the colonies perish rather than abandon a principle;" and when it was shown to him that facts were opposed to his theory, he contemptuously replied, "So much the worse for the facts."

"Everything else being the same, the penetration" (of projectiles into armour plates) "will be the deepest, when the material is most immoveable." With profound amazement I read these words, propounded as an axiom, in Mr. Cheverton's letter. To leave no doubt of his meaning, he explains that this opinion, which he unequivocally stamps with the seal of the settled conviction of his mind, refers to "the rigidity or yielding of the materials, whether such yielding be of an elastic or non-elastic character." I do not wish to hurt his feelings by demolishing a hobby which he is riding to death. I will not give an opinion; I will confute him with *facts*, which perhaps he will treat with the sovereign contempt of the republican French *savant*.

In the course of last summer the Iron Plate Committee made experiments for the purpose of determining the comparative resistance of rigid and yielding (elastic or non-elastic) material. Four plates of the same thickness and dimensions were fastened in the same manner, with through bolts, to four different kinds of structure—one of solid slabs of cast iron, one of solid blocks of granite, one of solid oak, one of alternate layers of cork and kamptulicon, a preparation of india rubber. The different degrees of rigidity and elasticity named by Mr. Cheverton were exactly represented. These plates were fired at successively with a 40-pounder gun, with the same charge of powder, the same weight, form, and diameter of projectile, and at the same range, 200 yds., "*Everything else*" (but the rigid or yielding nature of the materials) was, as Mr. Cheverton desires, "*the same*." The results of the trials were as follows:—

On the most rigid and unyielding structure, that of cast iron, the penetration was *nil*, the shot making only a slight mark on the iron plate. On the structure next in degree of rigidity, that of granite, there was a slight indentation about a quarter of an inch. On the yielding, but not elastic structure, the solid oak (3 ft. to 4 ft. in thickness), the penetration was *through the plate* and about 15 in. into the wood. As to the elastic structure, the projectile penetrated and smashed through the plate and everything behind it.

It really is a waste of time and of your valuable space to dwell so much on a point, so obvious to common sense, as the superiority of rigid over elastic or yielding resistance to projectiles. But the pertinacity of Mr. Cheverton, and other theorists, who erroneously assimilate the resistance to projectiles, at high velocities, to the resistance to other forms of force or pressure, makes it desirable that publicity should be given to the practical results of experiments. If there were any truth in the theory that "penetration will be the deepest where the material is most immoveable," it would follow, that the thicker a plate of iron is, the deeper would a projectile penetrate into it, which is a manifest absurdity.

I am afraid I shall again shock Mr. Cheverton's "fancies" by stating that the smashing and penetrating effects of a shot are co-equal against the same structure, the force of the projectile at the moment of impact and its form and sectional area being the same. The contrary opinion is a fundamental error of the Armstrong theory, which it was one of the objects of my letter, printed in the Mechanics' Magazine of the 16th inst., to point out and prove by experiments therein referred to.

What, I will now ask, is to be thought of the following passages in Mr. Cheverton's letter? Referring to my explanation, that rifling was the cause of the long range of the American guns, he *first* says, "the long range is ascribable to the application of rifling to guns, as a practical expedient to secure the parallelism of a long projectile to the end of its flight"—an enunciation, in scientific phraseology, of the effects of rifling, or rather of the rotary motion resulting from rifling, which is known to every tyro in gunnery. He then adds, "it (the long range) is not (as I stated it was) ascribable to the rifle principle." What, then, is the rifle principle? Is it anything else but what he himself describes? No comment is necessary on so palpable an equivocation. I can afford to bear these petulant remarks. Mr. Cheverton, it appears, cannot forgive me for having, on former occasions, showed that he misapprehends and misapplies theories, and is deficient in practical knowledge. It has with truth been said, that an ounce of practice is worth a ton of theory.

Civilian.

BOILER EXPLOSIONS.

Sir,—During a tedious epistolary discussion, to which I referred in my letter to you a fortnight ago, Mr. Clark sent me an incoherent communication, which, with others from the same source I,

not long afterwards destroyed, partly in pity for its author; but I am willing to accept his present reproduction of it as literally exact. I will say nothing of its dignity, nor of the calm, philosophic tone which pervades it throughout. It professes to recapitulate the whole history of the "percussive theory," and it contains only two dates—viz., that of the first publication of my views, September 16, 1859, and that of the first publication of a single surmise, by Mr. Clark, February 10, 1860. From the presbyterian division of this "recapitulation" into paragraphs down to eighteenthly, these are evidently intended to represent the order in which the events which they profess to narrate took place. But No. 7, which contains the essence of Mr. Clark's notions of explosions, comes *before* No. 9, which relates to the explosion on board the "Great Eastern." Now, Mr. Clark has lately said that he "started the projectile theory" shortly after that explosion, viz., on the 12th or 13th of September, 1859, in a conversation with Mr. Holley and myself, although I have proved an *alibi*. Furthermore, Mr. Clark said nothing of "the violent separation of steam and water dashing the contents like small shot against the surfaces of the boiler," until the evening of November 5, 1859, nearly two months after the explosion, I then noted down the suggestion as he made it, with a few others upon the same subject, upon the margin of a slip of newspaper, on which was printed "The *Times*, Friday, November 4, 1859." I kept this for some months, and many of my friends saw it. Had Mr. Clark advanced this idea before, I should have introduced it into my writings; but it nowhere appears in them until in my tract of 1860. So much for "No. 7, D.K.C., roused."

I will now briefly comment upon this "recapitulation."

No. 1. Perfectly true; and many others had said and recognized the same things.

No. 2. True.

No. 3 is erroneous in the use of the word "all" instead of "some of." I had told Mr. Clark, a few weeks before the "Great Eastern" explosion, that when the parts of a boiler had been once torn asunder, *from any cause*, the additional steam disengaged from the water would account for the distance to which they would be thrown. This was but a repetition of what I had written in the *American Engineer* in 1857.

No. 4. Last lines of paragraph. This was Mr. Clark's constant and irrelevant reply *after* I had explained to him the "Great Eastern" explosion.

No. 5. So I had "strangled" all theories based on electric action? Then why did Mr. Clark, knowing this on February 13, 1860, write you on May 3, 1861 (Mechanics' Magazine, Vol. 74, No. 1,969, page 307), that "the writer in 1859 appears to have had some notion of electrical action in his mind"?

No. 6. I doubt not that I "hammered" at Mr. Clark, "made no progress" with him, "wondered" at his difficult perception, and "said there must be something yet not understood" by him. This is my general recollection of discussions extending over two months, until he, at last, appeared quite convinced.

No. 7. Already noticed; the date of this arousal being November 5, 1859.

No. 8. I often asked Mr. Clark if he did not believe the weight of the steam, considering its velocity, to be sufficient to produce a *blow* causing explosion. I pressed this strongly upon him on September 14, 1859. On the 4th of November following, Mr. Clark did give me, and for the first time, "various illustrations," with which I was much pleased. I presume Mr. Clark recollects giving me these illustrations in his *new* office, into which he had only removed while I was absent in Paris from October 15 to November 1. If he does not, his former assistant does. This gentleman, I may add, heard nearly all our previous conversations upon the subject. No leaders upon explosions, "lucid" or otherwise, appeared in the *Engineer* for about a year after the time when Mr. Clark gave me his "various illustrations."

No. 9. Indeed! "D. K. C. *gave*" the "circumstances" of the "Great Eastern" explosion to "Z. C. and A. L. H"! Mr. Clark, who, for anything I know, may have never seen the "Great Eastern," "gave the circumstances" of the explosion to Mr. Holley, who, while in conversation with the present Duke of Sutherland, Lord Alfred Paget, Mr. Nasmyth, Mr. Francis Pettit Smith, and Mr. McConnell, *saw* the chimney go up before his own eyes, and who spent several hours in examining every detail of the wreck! To go on, I was not and am not now "at home" with Mr. Clark's views, although I think I can see their impracticability pretty clearly. And so Mr. Galloway, with his incredible *pressure*, was right? Mr. Clark may think so if he likes.

No. 10. The precise condition in which heated water rises upon a sudden removal of pressure, is still a moot point. It may all go into fine, hot mist,* and the word "steam" might be hastily and not altogether inappropriately used to express this.

No. 11. The article *Steam*, ably compiled by Mr. Clark from the writings of Mr. Scott Russell, Professor Rankine, and others, has often been of service to me, and I was certainly glad to obtain it.

Nos. 12 and 13. True, although the facts might be better expressed.

No. 14. When and how did Mr. Clark show his "resentment"? As nearly as I can ascertain, it was in January, 1860, when he found that others were giving me credit for what he had, in more than one conversation, freely acknowledged to be mine alone. The manner of his "resentment" was in privately claiming to have supplied me with the ideas contained in a long series of articles, some of which, I may now say, were written partly with the hope of convincing *him*. Gross provocation and noble resentment!

No. 15. This is magnanimous, for I have given Mr. Clark occasion to think much more severely of me than as a "compiler," &c.

No. 16. In direct contradiction with Nos. 1 and 2.

No. 17. See reply to No. 10.

No. 18. This was the first and only contribution by Mr. Clark to the present or any other theory of boiler explosions.

As to my history of our conversations, Mr. Clark raises nothing in dispute of it beyond a general denial, the value of which may be judged by two others which immediately follow it. He denies having used an oath. The conclusion of his last letter to me, in February, 1860, was "damn Harshman." This, which I showed to many of my friends, may not have been an oath: it was, however, a curse. Mr. Clark denies that he acknowledged appropriations from the *Engineer* in the *Encyclopædia*. The acknowledgment endures, however, in plain characters at the bottom of the 625th page of the 20th volume. Of equal force are all Mr. Clark's denials.

As to Mr. Clark's postscript, I should be ashamed to quote it. The language of prize-fighters, always disgusting, is, if possible, more so in your columns; and I can only express my astonishment at the infatuation of a man who employs such language in the attempt to establish for himself a claim to a scientific truth, and in the presence of men like Lord Brougham, the Astronomer Royal, Professor Faraday, Dr. Fairbairn, Professor Rankine, Dr. Joule, and hundreds of other distinguished men of science, who, I have reason to know, read the Mechanics' Magazine.

I am the defendant in this action in which Mr. Clark now first publicly attempts to wrest from me my title—for four years undisputed—to the now received theory of boiler explosions. As in all litigation, the defendant is expected to reply upon every point, and he must avail himself of his privilege of the "last word," or abandon his suit. I thus defend my title, most unwillingly, and I shall heartily rejoice when the time for summing up this case arrives. This correspondence costs me much valuable time which would never be given to it, except under a strong sense of duty to myself. I feel that I do myself little credit in noticing one who has nothing to lose and everything to gain in this matter, but every line that he or I write at once passes into history. I must needs, therefore, have patience.

I may now close by reverting to the fact that all that Mr. Clark has ever published upon the *rationale* of boiler explosions (with the exception of his contribution to the *Encyclopædia*, duly acknowledged to the *Engineer*, and reflecting at nearly every line the ideas of my tract of April, 1860) was his note to you of February 10, 1860. My writings, beginning in 1857, embodied the present theory in September, October, and November, 1859, and in my tract of April, 1860, and they have been dedicated to an almost constant illustration and defence of that theory ever since.

I am, Sir, your obedient servant,

Zerah Colburn.

3, Upper Bedford-place, Russell-square,
October 24, 1863.

* See the Mechanics' Magazine for September 18, 1863, page 652.—[Ed. M.M.]

BOILER EXPLOSIONS.

Sir,—As regards the difference of opinion on particular theories brought forward in your magazine, by those who, we presume, have both time and abilities for such a scientific research, I think it would be more beneficial to your readers and to the public were those gentlemen, instead of sparring to no purpose, to point out some plan to prevent boiler explosions, according to their different dogmas. I would advise a simple experiment to be tried, to satisfy those who may feel interested. Have two lightly-constructed small round vessels, to which attach a large plug-cock; fit them to a boiler of high-pressure steam; fracture both vessels; fill one with water, draw the triggers, and I think it is quite evident which will show the largest compound fracture.

Yours truly,

John L. Winton.

13, Gladston-street, St. George's-road,
Southwark, Oct. 26, 1863.

"THE GREAT EASTERN."

Sir,—The remarks of your correspondent Mr. Kennedy, in your journal of the 9th inst., are, to a certain extent, very sensible. I fully concur with him in curtailing the length of the "Great Eastern;" but I would slice off 80 ft., being 30 ft. more than he proposes—most certainly strip her of her paddle-wheels and paddle engines—and give her two screws, one under each quarter. To prove a great success, the screws should feather, thereby economising fuel and time; but to dispense altogether with her rudder, would be very unwise—fuel exhausted, no steering. The style of rig suggested by Mr. Kennedy I believe to be correct.

Mr. Kennedy evidently possesses good inventive abilities. Can't he give us nautical men a good *substantial feathering* screw? We dread the lingering and unsatisfactory operation of connecting and disconnecting "which the screw in present use involves;" and after the latter has been accomplished, we have the mortification of dragging the screw after us, thereby depriving the ship of two or three knots an hour; in fact, screw propulsion will never be fully developed until we have the screw to feather; the sooner the better, both for the pockets of the owners and those who have the command of screw auxiliaries.

I am, Sir, your obedient servant,

T. Box.

Rotherhithe, October 20, 1863.

Meetings for the Week.

Mon.—*Royal Inst.*, General Monthly Meeting.

Wed.—*Geological Soc.*, 1, "On Some Ichthyolites from New South Wales," by Sir P. de M. G. Egerton, F.R.S. 2, "Notes on the Geology of a Portion of the Nile Valley, &c.," by A. L. Adams (communicated by L. Horner, Esq., at 8 p.m.

Sat.—*London Assoc. Foremen Engineers*, "On Hollow Castings in Iron," by Mr. W. W. Oubridge, at 8 p.m.

Miscellanea.

A prospectus has been issued of the Lundy Granite Company with a capital of £100,000 in shares of £5. The object is to work the stone quarries in Lundy Island, North Devon. The company have a contract to supply the stone for the first section of the Thames Embankment.

The plates out of which the "glacis" plates which are to encircle the base of the "Royal Sovereign's" turrets on her upper deck are to be made, have been received at Portsmouth yard, and handed over to the steam factory department to accomplish the work. This will be one of great difficulty, and will only be eventually accomplished, if carried out in the way now proposed, in the utter destruction of all the shot-resisting qualities of the plates. The proposed plan is to take the now perfect masses of metal in all their rough strength, carve them out in all manner of semicircular lines, and then plane them down from their inner 5½ in. thickness of inner edge to nothing on their outer edge or circumference, thus destroying the skin, fibre, and strength, or shot-resisting power, of the metal, and making it certain to break up under even the shot of an ordinary 68-pounder like pottery ware. If this course is persistently pursued the cost will be enormous, and the ship cannot be finished before March next. By a rougher and simpler disposition of the [illegible] ing to form the glacis, ten times the str[illegible] tained, with th[illegible] mount of [illegible] nd at one- [illegible] f th[illegible] ompleted

in one-third of the time. It is but just to the steam factory department to say that its chief is fully aware of the vast difference in the two plans, and in favour of the shorter and more economical one. The "Royal Sovereign" is but an experimental ship after all.

The Channel fleet will shorty make a further, and, perhaps, a more practical trial of the seagoing qualities of the different ships composing Rear-Admiral Dacre's command, by taking a trip to the Tagus. The fleet will probably be absent from England about six or eight weeks.

Tenders have been issued by the War Department for the contract supply of a large amount of pig-iron, to be delivered at the royal gun factories at Woolwich arsenal, to be prepared for the manufacture of the new species of naval guns, fifty of which are ordered to be commenced forthwith. The gun, it is stated, will be somewhat similar to the 100-pounder smooth-bore gun which withstood a severe experimental test at Shoeburyness, at the commencement of the past summer, and which was afterwards tried with success on board the gunnery ship "Excellent," at Portsmouth.

We learn from the Liverpool papers that an important addition has just been made to the class of steamships that are designed for the passenger trade between England and Australia. The magnificent vessel we allude to, the "Royal Standard," has been built expressly for Messrs. H. T. Wilson and Chambers, the owners of the Liverpool and London "White Star" line, by Messrs. Palmer Brothers, the celebrated iron ship-builders, of Newcastle-on-Tyne, especially for the passenger trade. The "Royal Standard" is a craft of beautiful symmetry and great size. In total length she measures 283 ft. over all; her moulded breadth is 40 ft.; her depth of hold is 27 ft. 6 in.; and her gross measurement tonnage is 2,000 tons. She has been built on exceedingly fine lines, with a keen cut-water, a well rounded waist, clean run aft, and a sweetly moulded stern. In these respects the "Royal Standard" possesses all the best characteristics of a first-class clipper, her general trim and rig being those of the best order of passenger clippers; to these highly-desirable attributes it is only necessary to add that this beautiful vessel has an auxiliary screw propeller, worked by steam engines of 165-horse power, but capable of being worked up to 500, and furnished with surface condensers and every modern improvement, thus ensuring, as far as human means can do, a vessel that is certain to perform even the longest voyages with steady celerity and regulated speed. In the trip from Newcastle to Liverpool the "Royal Standard" gave every satisfaction, Captain Allen reporting himself in every way pleased with her steaming and sailing qualities, stating that she "steered like a boat," and that in whatever part of the ship he was in could not detect the vibrations from the engines. She steamed eight knots against a strong head breeze, 10½ to 11 under stay-sails, and 12½ with the wind abeam.

Aluminium bronze, which is an alloy of aluminium with copper, has for some time been in use in Birmingham, and it has been worked into a variety of useful and ornamental articles—for instance, watch cases, watch chains, brooches, and many little trinkets—and the metal looks so gold-like that when nicely polished it cannot by the eye alone be distinguished from gold. Now we have it applied to another purpose. Messrs. C. T. Lutwyche and Son have patented the application of it to the manufacture of writing pens. They profess that pens made of this metal are, in appearance, equal to those made of gold, and are quite as incorrodible; that they write as smoothly as quills, whilst the price is so reasonable that any one may purchase them.

Graham's Shoal, between the island of Pantillaria and the town of Sciacca, on the coast of Sicily, which first appeared in 1831, has again risen out of the sea.

The last idea of Paris is a plan in alto-relievo of the whole of Europe, not in maps of models, but actually raised out of the ground. A garden is to be set aside for the modeller, who is taking "Mont Blanc," 15 feet high, as his *point de depart*, is to raise in just proportion around it the rest of the mountains of Europe, pour the seas into their proper places, and intersect the whole with roads, canals, railways, and telegraphs. A steam-engine is to act the part of moon, and regulate the tides. It will be a geographical garden, where "he who runs may read."

The *Army and Navy Gazette* states that on the express requisition of the Amiralty the War Department has ordered the manufacture of 50 muzzle-loading guns to be at once commenced in the Royal Arsenal. Since the introduction of steel inner tubes, the coil system, which was first carried out with modern appliances by Professor Treadwell in America, and more lately advocated by Mr. Longridge, C.E., and Captain Blakely, R.A., has been developed by Sir W. Armstrong, so that it may be safely asserted that the Woolwich establishment is able to turn out built-up guns which are well worth their cost. We do not assert that these built-up guns are better or even equal to the solid forgings of Krupp, but we believe they will be good guns.

Mr. Richard Hugh Hughes, of Hatton-garden, in a letter to the *Daily News*, says:—Your readers are already aware that I have patented a system of ventilation exactly opposed to the previously conceived notions upon the subject; instead of producing the current by exhaustion, I propose to produce it by propulsion. Now, the system in use has proved to be imperfect, and all that I ask is to be afforded an opportunity of proving, whether or not I have made any nearer approach to perfection. I only desire that my invention should have a fair trial, and I will willingly permit its use in a colliery, free of all fees or royalties whatever, that its merits may be tested. It appears to me so evident that by substituting propulsion for exhaustion, we shall keep the gas in the coal until the moment it is broken by the workmen, instead of drawing from every possible point as we do at present, that I am very sanguine of the results which are obtainable; and I shall be disinclined to acknowledge that I am wrong in principle, until my invention has had a practical trial, or until some valid argument against it is given by your correspondents.

Prosperity prevails among French ironmasters in consequence of fresh orders received from Italy, Spain, Russia, and Egypt. The construction of docks at St Ouen and the Government works at the Palais de Justice, the New Chamber of Commerce, the Conservatoire des Arts et Metiers, the School of Mines, and the orders received from the company formed for lighting Caen with gas, are keeping them fully employed. The preparations for bringing the waters of the Dhuys to Paris, and the construction of reservoirs, are conducted with great spirit. Artistic ironworks are now carried to great perfection in France, as may be seen by the very handsome railing just finished for the Museum of Napoleon III. at Amiens.

Mitchell's waterproof floating mail-bag has been exhibited in the Exchange News-room, Liverpool, under the direction of the inventor. It is a strongly-constructed bag, made of the best "duck," or sailcloth, thoroughly impregnated with caoutchouc, and consequently completely waterproof. From this quality it is more or less buoyant on account of the quantity of atmospheric air it contains, and so becomes valuable. The specimen exhibited in Liverpool, is about 3 ft. long, 1 ft. broad, and about 6 in. deep. This bag was well filled by a miscellaneous collection of materials, such as may be expected to find their way into a mail bag. They consisted of newspapers, numerous loose papers, a comparatively large number of books, and to give weight in an additional degree, two common building bricks, the whole forming a very heavy mass compared with the size of the bag. The whole, however, was buoyant, and on opening the bag it was found that not a drop of moisture had permeated into it. The inventor also states that he has arranged a means by which the whole contents of a ship's mail-room may be made buoyant, and connected so as to form a raft or buoy in case of necessity.

A large Martin boiler, intended for the United States gunboat "Sunapee," burst in the Washington Iron Works, at Newburg, N. Y., where it was being tested. Several persons were fatally scalded, and the buildings were demolished. This is the first case on record, we think, of this sort of boiler exploding. The loss, amounting to 25,000 dols., falls on the company.

A company has been formed for carrying on the manufacture and extending the sale of "Muntz's Metal," which for many years has superseded, to a great extent, the use of copper for marine and other purposes. For this purpose it is proposed to raise a capital of £600,000, in 30,000 shares of £20 each, but it is not expected that more than £12 10s. per share will be called up. Mr. Muntz takes a seat at the direction, and receives 2,500 paid-up shares, representing £50,000, for the good-will of the business, whilst the company obtain the freehold of the works with all the plant at a valuation, the stock in hand being taken at current prices on the day of transfer. The works are in full and extensive operation in Birmingham, they are returning large profits, and the company will come into their possession without the suspension of a single day's working.

The Paris correspondent of the *Building News*, states that a project is talked of for the formation of a submarine railway between France and England. According to the *Journal du Havre*, this railway is to be, not under the sea, but in the sea. A tube or entire tunnel is to be constructed, divided into 100 compartments. This tube, which will traverse the railway, is to be surrounded with another iron tube as a protector. The interval between the two tubes is to be fortified with brick-work. Means of obtaining air will not be wanting, that part of the problem having been solved, at least, theoretically, by those who have proposed a tunnel under the Strait.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgment:—

Steam Engines, &c., 756, 781.
Boilers and Furnaces, 736, 763.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 759, 769.
Ships and Boats, including their fittings, 776.
Cultivation of the Soil, including agricultural implements and machines, 751, 654, 667.
Food and Beverages, including apparatus for preparing food for men and animals, 737.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 746, 757, 758, 773, 778, 780, 782.
Buildings and Building Materials, 752, 772.
Lighting, Heating, and Ventilating, 747, 753, 755, 762, 764, 765.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 734, 741, 743, 749, 760, 766, 775.
Metals, including apparatus for their manufacture, 738, 739, 742, 745, 748, 771, 774, 777.
Chemistry and Photography, 731, 732, 733, 761.
Electrical Apparatus, 768.
Warfare, 750.
Letter-Press Printing—*none*.
Miscellaneous, 735, 740, 744, 770, 779.

731. W. Lorberg. *Improvements in the treatment of rags and obtaining valuable chemical products from the animal fibre therein.* Dated March 18, 1863.

These improvements relate to the treatment of—1, mixed fabrics containing vegetable fibre and animal fibre, known in the trade as linseys, stuffs, bodies, challies, and the like; 2, printed cotton goods, known as chintzes, furnitures, prints, and the like; and have for their object the separation or recovery, the cleansing and bleaching, of the vegetable fibre, and obtaining valuable chemical products from the animal fibre. For the purpose of separating the vegetable from the animal fibre, he steeps the goods in a solution of caustic, alkali, soda, or potash, which disintegrates or dissolves out the animal fibre, such as wool, silk, hair, without sensibly attacking the vegetable fibre. This solution also decomposes or breaks up some of the colours or dyes, and removes most of the dirt, grease, or other impurities contained in the rags. The selection of alkali depends upon the uses for which the wool liquor, or solution of wool, is to be employed; and the strength of the alkaline liquor is of course varied according to the quality of the goods operated upon. The action takes place in the cold, but heat accelerates it. After this process the goods are subjected to strong pressure, in order to force out the disintegrated wool, together with the alkaline liquor retained in them, and are then thoroughly washed in plenty of water, after which they are immersed in an acid bath, containing from 1 to 5 per cent. of acid, generally sulphuric, where they must remain for a longer or a shorter period, until the decomposition of the more refractory colours is complete. They are again washed, and ultimately submitted to the action of one or more of the well-known bleaching agents, such as chloride of lime, chloride of soda, or potash, sulphurous acid, when they will come out white and clear. The spent liquor from the first process containing the wool and other animal matters in solution, and being, therefore, very rich in nitrogen, he employs for the manufacture of manure, ammonia, or cyanogen compounds. *Patent abandoned.*

732. A. Morel. *Improvements in apparatus for generating carbonic acid.* Dated March 18, 1863.

Carbonic acid gas may be easily produced by pouring an acid on a carbonate, such as marble, chalk, or bi-carbonate of soda; and this very facility of production creates variations of pressure in the generator, which requires continual attention, as also a gas-holder for containing the gas. This invention relates to an improved generator of

carbonic acid which is self-supplying, and regulates itself at a constant pressure without any supervision, and producing a regular current of gas without the aid of a large gas-holder or regulator. *Patent completed.*

733. J. D. and A. P. WELCH. *Improvements in bleaching and reducing and brightening the colour or tone of dyed straws, plait, and straw.* Dated March 18, 1863.

This invention consists of improvements in the treatment of straw plaits and straw, by first dyeing or staining them, and then bleaching and reducing their colour, whereby the straw acquires a brighter appearance, the colour being reduced to a neutral and uniform tint. *Patent abandoned.*

734. G. HASELTINE. *Improvements in the manufacture of boots and shoes.* (A communication.) Dated March 19, 1863.

This invention relates to the fastening of the soles to the uppers of boots and shoes by means of rivets that are incorporated with the sole, and that pass through the edges of the insole and the upper, and have the points of the adjacent rivets clenched in opposite directions. *Patent completed.*

735. E. LEVER. *An improved composition for the coating and preservation of canvas and other materials to make them waterproof and non-inflammable.* Dated March 19, 1863.

This consists of a composition or compound of about 4 parts quick lime, 3 parts glue, 3 parts whiting, 3 parts gum arabic, 1 part Epsom salts, and 4 parts alum, dissolved in a sufficient quantity of water to make it of a proper consistency for the purpose required, or the material to be operated upon. *Patent completed.*

736. H. WILDE. *Improvements in the construction of steam boilers.* Dated March 19, 1863.

The patentee claims the placing of a fillet or band of copper or other suitable metal between the joints formed by the overlapping of the plates, or between the plates and angle irons, and allowing the said fillet or band of metal to extend beyond the joints in the interior of the boiler, in the manner and for the purpose described. And he also claims for the same purpose the coating of boiler plates, at or near the seams, with copper or other suitable metal. *Patent completed.*

737. H. O. HAUGHTON. *Improvements in machinery for drying and cooling grain and seeds.* (A communication.) Dated March 19, 1863.

For the purposes of this invention the grain or seed is fed from a hopper, or other suitable source of supply, on to one end of a perforated floor or platform at the bottom of an enclosed chamber. The quantity supplied is regulated by a slide or suitable valve. The upper part of the chamber is covered by an arch or double inclined roof, where there is an outlet for the passage of the air and vapours arising from the grain or seed which is spread on and gradually moved along the perforated platform or floor. The grain or seed is caused to move on the perforated floor by means of an apparatus carried by two endless chains, which are caused to circulate within the enclosed chamber, and above the perforated floor or platform. This apparatus consists of axes or shafts which are placed transeversely across the chamber. On each end of each of these shafts or axes is a flanged wheel, and these wheels are supported by and run along two pairs of parallel guides or bars fixed on each side of the chamber, and these pairs of guides or bars are arranged one over the other, so that when the wheels of each of the shafts or axes arrive at the end of the upper guides or rails, they descend on to and run along the lower guides or rails and then again ascend to and run along the upper guides or rails. These endless chains pass round chain wheels at each end of the chamber, so that by giving motion by any suitable power to one of the axes on which the chain wheels are mounted, the whole of the apparatus is put in motion. On each of the shafts or axes is mounted a series of short axes at right angles with those which carry them, and on each of these short axes two flaps are mounted, in such manner that the two flaps may radiate from their axis, and be set to a greater or less inclination thereon as the endless chains travel. These sets of flaps are moved along the perforated floor or platform, and by so doing they move more or less of the grain or seed spread thereon from one end to the other end of the chamber, according as the pairs of flaps are for the time set to a greater or less angle to each other on their axes. Below the perforated floor or platform means of obtaining and supplying heated air are applied, which consist in fireplaces from which proceed tubes or metal flues taking an indirect course to the chimney, so as to obtain extended heating surface in the chamber below the perforated floor or platform. It is preferred to have two fireplaces, and to divide the lower part of the lower chamber longitudinally by two partitions; also to have at each side openings with a sliding cover or valve to regulate the introduction of air into the lower chamber. Between the perforated floor or platform and the heated pipes or passages are inclined plates having a longitudinal opening between them, up through which the heated air passes, and thence through the perforated floor or platform, and amongst the grain or seeds spread thereon, and such heated air and the vapours rising therewith from the grain or seed are carried off by a fan at the opening in the roof before mentioned. The grain or seed as it arrives at the end of the perforated floor or platform descends on to an inclined sieve or perforated plate, down which it slides, and from the lower end of which it is delivered to a suitable shoot. *Patent completed.*

738. J. SAUNDERS and J. PIPER. *Improvements in apparatus employed in the manufacture of tin and terne plates.* Dated March 19, 1863.

For the purposes of this invention, in order with more advantage to carry on that part of the process where tin or terne plates are used to pass through heated grease to equalize and to remove the excess of the coating, apparatus is employed arranged and combined in the following manner:—A pair of rollers is placed and revolve in a shallow trough or vessel, and they are mounted in bearings which are carried by levers which are pressed together by springs, so as to produce the desired pressure or nip to the rollers. The grease is retained in this trough or vessel to any desired height by means of an overflow-pipe, the delivery end of which may be raised or lowered to any required point. There is also a separate grease trough at one end, in which the necks of the rollers, their axes, and clutch-boxes revolve, from which also there is an overflow pipe. The axes which give motion to the rollers are driven by friction surfaces, which are pressed together by a weighted lever. Below the trough in which the rollers revolve, and in connection therewith, there is a descending trunk, the lower end of which descends to the bottom of another trough, into which the tin or terne metal removed from the plates descends, and from it such metal is removed. There are openings at the lower end of the trunk through which such metal flows into the receiving trough below, whilst the melted metal in the lower trough supports the grease in the trunk, and in the upper trough or vessel. The coated plates are placed in succession into a portion of the upper trough or vessel, which is divided off by a partition, and each plate as it is introduced descends into the trunk till its lower edge rests on a lifting bar or cradle therein, and such plate is then caused to assume a vertical position in the cradle by fingers which are mounted on an axis above. These fingers give way as the plate descends in an inclined position into the trunk, and then the fingers by pressing against the plate cause it to assume a vertical position in the cradle, which is below the nip of the rollers. The lifting bar or cradle is then raised by a lever handle, which brings the upper edge of the plate to the nip of the rollers, so that by the revolution of the rollers the plate is raised out of the grease, which is kept heated by any suitable means. *Patent completed.*

739. S. L. CROKER. *A new and useful or improved yellow-metal sheathing nail or spike, which, by means of a nail-cutting engine, is cut from yellow sheathing metal.* Dated March 19, 1863.

Yellow metal, when in a cold state, cannot be used for the manufacture of cut nails or spikes in a nail-cutting machine, the great frangibility of the metal preventing the nails or spikes from being cut and headed. The patentee has discovered that by heating it to redness, or thereabouts, and while so heated introducing it into the nail or spike machine, it may be safely cut up into nail blanks, and each of the said blanks can be headed by the machine. After the nails or spikes, as the case may be, have been thus made, they are to be again heated to or about to redness, and when so heated they are to be plunged into cold water. In consequence thereof their brittleness will be so overcome as to render them capable of being bent or driven without that danger of being broken under such operations as the common cast composition nails or spikes would be subject to. *Patent completed.*

740. C. WEBSTER and W. FORGIE. *Improvements in apparatus for the purpose of clearing out the interior of foul chimneys or flues when on fire or otherwise.* Dated March 19, 1863.

This apparatus consists of a series of steel or other hard malleable metal strips or material, by preference, about one-eighth of an inch thick, and three-fourths of an inch broad, and divided into eight or other suitable number of equal parts about eight inches long, more or less, according to the size of the apparatus required. These parts are formed into semi or half circles upon edge, with saw teeth cut thereon, and attached to or mounted upon a steel spindle or rod of metal, by preference about half an inch in diameter, and about twelve inches long, having joints near each end to which the parts previously described are attached, part at one end and part at the other, so that the unjointed ends of the strips meet and overshoot each other, and although coupled together they are quite at liberty to expand by means of self-acting springs, which cause the apparatus when at liberty to do so to expand into a globular shape, but when compressed they contract into a smaller compass, and thereby the apparatus adapts itself to the interior form of the chimney or flue, or any inequalities thereof. The apparatus is worked by means of a series of rods made of steel or other hard material screwed to the apparatus, and in succession to one another, by which it is moved up and down the chimney or flue, and if the same is on fire, a lever handle is employed to work the apparatus to and fro in the flue, by which great power can be imparted thereto, and at the same time permit the operator to stand at a safe distance from the burning material as it is discharged from the flue. *Patent completed.*

741. G. H. SMITH. *Improvements in sewing machines.* Dated March 19, 1863.

This invention relates to the means of producing the feed motions of certain sewing machines known by the name of double or back-action machines, and consists in the combination of a lever working on a universal-jointed or double-action fulcrum, and actuated by a double tappet, on which lever is suspended from or near the end thereof a feeder, with a universal or double-action joint at the upper part of the feeder, admitting of its being moved either forwards or backwards, across the arm of the machine, or at right angles to such direction of motion. This feeder acts in combination with a double guide capable of being moved and set as required to form a guide way for the feeder in either of its respective motions, and a bevel formed on the operating end of the working lever, or on the end of a fixed spring, and impelled by the said lever for the purpose of acting on a bevel formed on the feeder, in order to produce the required motion of the same, either in the direction of the length of the arm of the machine, by the one bevel sliding over the other, or in the direction across the arm by the pressure of one bevelled piece on the other. By means of this combination, the feeder is worked through the several motions required for propelling or feeding the article to be sewed, either across or up the arm of the machine by the agency of one lever, instead of requiring two or more levers, as usual, such lever having a fulcrum with a universal or double-action joint, and being worked by a double tappet on the driving shaft. *Patent completed.*

742. W. REAY. *An improved machine for amalgamating minerals and other metalliferous and metallurgical products and substances.* Dated March 19, 1863.

This invention is not described apart from the drawings. *Patent completed.*

743. R. COUCHMAN. *Improvements in articles or means for supporting or carrying ladies' parasols, bags, or other articles or appendages.* Dated March 20, 1863.

This invention consists in attaching to a lady's waist band, belt, or other suitable part of a lady's dress, an instrument so formed as to be suitable for receiving and holding the handle of a parasol, bag, or other article or appendage. For this purpose a simple form of instrument of this character may be constructed of wire, or from stamped metal, bent into such a form that one part thereof may pass over and be secured to a lady's belt or waistband, or be otherwise secured to part of the dress. From the front of the instrument arms project capable of springing together in order to hold and support the handle or other part of a parasol, bag, or other article when inserted therein, the space between the two arms being secured by means of a chain, ring, spring, catch, or otherwise. Instruments of like character for this purpose may be formed of cast metal, or of other suitable materials. *Patent abandoned.*

744. A. BARCLAY and A. MORTON. *Improvements in certain apparatus for injecting and ejecting fluids.* Dated March 20, 1863.

This invention relates to an apparatus whereby the ejection of water or other fluid causes the injection of water or other fluid without the intervention of pumps or other moving machinery. One mode in which this invention may be carried out consists in the placing of two flat or curved discs parallel or nearly so, and near to each other, but with a small space between. One of these discs, with a pipe or pipes attached, communicates with the actuating fluid by an orifice through the centre of the disc; whilst the other disc, with its pipe or pipes attached, communicates with the water or other fluid to be actuated upon by an orifice at some distance from its centre. This orifice may be either a ring of holes, slits, or openings of any similar kind. When steam or other actuating fluid is admitted through the orifice in the centre of the former disc, it impinges against the solid centre of the latter disc, and radiates in a thin sheet between the two towards their circumference. This motion causes the fluid now acted upon to be drawn or forced through the ring of holes, slits, or other openings, and carried along with the actuating fluid for the purpose of being injected or ejected. *Patent abandoned.*

745. J. and T. A. NIELD. *Improvements in core barrels.* Dated March 20, 1863.

This invention relates to core barrels for casting pipes, columns, cylinders, or other artices of cast iron or other metals. The core barrel may be made of any desired number of segments or curved plates, joined together by hinges, and at the ends and middle of each segment there is a curved projection or lug. Through the interior of the barrel there is a shaft, having fixed to it a number of cams corresponding with and working in juxtaposition with the lugs or projections on the segments. When the shaft is turned until the largest radius of each cam is in contact with its corresponding lug, the core barrel is expanded to its largest diameter; but when the shaft is turned, so that the cams are between the curved projections or lug, the barrel is allowed to collapse. At each end of the barrel there is a plate which covers the cams, through which plate and one or more of the lugs a pin is inserted for the purpose of maintaining the barrel in its expanded condition. *Patent completed.*

746. R. A. BROOMAN. *Improvements in machinery for beating and drying wool, and other textile and filamentous substances.* (A communication.) Dated March 20, 1863.

This invention is not described apart from the drawings. *Patent completed.*

747. V. HOUGHTON. *Improvements in lamps and lamp wicks.* (A communication.) Dated March 20, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

748. G. WILSON. *An improvement in the manufacture of springs.* Dated March 20, 1863.

For the purposes of this invention, the heated end of a bar of steel is made to enter a cross-head, moved forward by steam or hydraulic pressure, or other means, the cross-head being shaped internally so as to bend the end of the bar of steel into a circle of the required size, the other end of the bar of steel being fixed in guides or slides, or by other means. *Patent abandoned.*

749. G. COLES, J. A. JACQUES, and J. A. FANSHAWE. *Improvements in machinery or apparatus for washing or wringing clothes or fabrics.* Dated March 20, 1863.

This invention relates to that class of machines in which the clothes are passed between rollers for the purpose of squeezing or forcing out the water that the clothes or fabrics take up from the vessel to which the washing, squeezing, or swinging apparatus may be adapted. The improvements consist—1, in a novel mode of constructing the squeezing rollers; 2, to an improved mode of mounting them. The first improvement consists in making one or both of the squeezing rollers cellular, and of some suitable elastic material. The cells of the rollers will therefore take up a certain quantity of suds or liquid, and when the elastic rollers are compressed by passing the clothes or fabrics between them, the liquid, being incompressible, will be forced or squirted through the fabric, and in so doing will effectually remove any dirt that may adhere thereto. When the machine is to be used for washing alone, two elastic rollers will be sufficient; but if the machine is to be a combined washing and wringing machine, then an additional smooth elastic upper roller must be employed. *Patent completed.*

750. C. PRYSE and D. KIRKWOOD. *Improvements in breech-loading firearms, part of which improvements are also applicable to other descriptions of firearms.* Dated March 20, 1863.

This invention is carried out as follows:—At the breech end of the barrel a charging chamber is formed, at the rear end of which, inside, a projection is made. This chamber may be constructed to close by means of a hinged cap at either side or above or below; by preference the top. The cap is raised by means of a lever working on a pin passing through the cap, and upon which pin is fixed a cam or eccentric turning with the action of the lever. Upon the inside of the cap is fixed a plug or breech piece, intended to force the cartridge into the barrel, so that, when charged, the cap down, and the lever turned into a line parallel with the barrel, the longer axis of the cam or eccentric is also in a line with the barrel, and a rise or projection, which is formed upon its lower part, being brought under the projection in the rear of the charging chamber, the whole of the parts are thereby securely locked together. For the purpose of more firmly packing the breech piece and avoiding windage or escape of gas, the end of the plug may, if necessary, be furnished with washers, which may be removed and replaced with new ones whenever requisite; or the chamber being formed slightly taper at the rear, and the cam of corresponding form, the projections on the cam and in the chamber may be dispensed with. The plug or breech piece being formed into the barrel is of itself sufficient security against the cap blowing up. Again, to effect a partial locking operation, an incline may be cut upon the cam, and a corresponding one in the rear of the charging chamber, which, acting after the manner of a screw, affords an additional security in case the lever be neglected. The lever may be prolonged in the direction of the cock or hammer, so as to prevent the cocking of the arm whilst in an insecure condition. Secondly, the invention comprises certain improvements in the nipple, applicable also to other firearms than breech-loaders. *Patent completed.*

751. J. BRIGHAM and R. BICKERTON. *Improvements in reaping and mowing machines.* Dated March 20, 1863.

The patentee claims—1, the system or mode of arranging and constructing reaping or mowing machines, with a cast-iron main frame formed in a single piece, and suitably shaped to receive the bearings of the several shafts and other details of the machine; 2, the general arrangement and construction of the mechanical details for adjusting the height of the finger bar and cutters by means of a simple movement of a hand lever, so as to cause the machine to cut the crop either close to or further away from the ground, as may be found desirable, as described. *Patent completed.*

752. F. DE WYLDE. *Improvements in the manufacture of cement from gypsum.* Dated March 20, 1863.

The patentee claims the manufacture of cement from gypsum with the solution of silicate and carbonate of potash, in the proportions and under the conditions specified. *Patent completed.*

753. J. M. EVANS and W. F. GRIFFITHS. *Improved means for ventilating mines.* Dated March 21, 1863.

This invention has for its object the ventilation of mines in an efficient manner by means of steam and heated air, without the use of open furnaces or fires. The inventors erect, contiguous to the upper part of the upcast shaft a tower or structure open at the top (except as hereafter described), and they lead from the lower part of this tower or structure a hot-air tube, or hot-air tubes, in communication with a fire-clay pipe or channel formed at one or at each side of the furnace in the form of a channel or hollow part of the brickwork of the furnace of a steam boiler, the air in this pipe being thus heated in the furnace, and supplying the interior of the tower or structure at the lower part; and they prefer to carry a steam pipe from the top of the said steam boiler into an upper joint of the interior of the said tower or structure, at the end of which steam pipe they provide a steam box having a ring or jet pipes projecting upwards therefrom. Above this steam box they also prefer o have attached at or near the top of the tower or structure an inverted cone or dome, to the end that a quick and adjusted draught may be obtained. The tower or structure containing the inverted cone or dome may be widened out, so as to have greater interior area in the upper part thereof, and the inverted cone or dome may be raised or lowered for adjusting the draught. The bottom of the tower aforesaid they make inclining to the centre, so as to be able to form a drain to carry off any condensed water that may fall. For mines having one shaft only the above arrangement may be connected with the upcast side of the lattice. *Patent abandoned.*

754. F. and A. ROBERTS. *Improvements in agricultural implements, and in apparatus for working the same.* Dated March 21, 1863.

This invention comprises various improvements in agricultural implements, and in apparatus for working the same, being more particularly designed for application in the cultivating system wherein two reversed sets of ploughs or other agricultural implements are drawn backwards and forwards between a steam engine, and a stationary pulley or anchor, or two steam engines or two anchors, some of the improvements being also applicable otherwise. *Patent completed.*

755. C. DE GROOTE. *Improvements in the construction of lamps with circular burners or wicks for the combustion of petroleum, schist, and other volatile oils, parts of said improvements being applicable to gas burners, night lamps, and lamps burning spirits and animal oils.* Dated March 21, 1863.

This invention relates to lamps with circular wicks, known as Argand burners, and more particularly to lamps in which petroleum, schist, and other volatile oils are to be used, and consists in adapting to such lamps wire gauze guards, through which the air passes to support combustion of the flame of the lamp. *Patent abandoned.*

756. G. A. BIDDELL. *Improvements in locomotives, usually called "traction engines," to be used on common roads.* Dated March 21, 1863.

This invention consists in the application and use of a friction clutch or clutches, in combination with suitable driving and dinengaging gear. The piston rod of the steam cylinder gives motion to the main or crank shaft, on which the friction clutches are, by preference, placed, although they may be placed on an intermediate shaft, one part having a sliding motion thereon, but always turning with it, whilst the other part which carries a toothed wheel is capable of turning thereon freely when the two friction clutches are not pressed together. On the main or crank shaft is a fly-wheel. The toothed wheel carried by the friction clutches gives motion to another toothed wheel fixed on a second shaft, on which second shaft are two toothed pinions, which turn with but can slide on that shaft. These pinions are coupled together by double-crank connecting rods and forked levers, or other suitable contrivance, in such manner that, when one is moved out of gear with its wheel, the other is moved into gear with its wheel. The crank by which these two pinions are slid is on a separate shaft, having a lever handle thereon, by which it can be turned in one or other direction at pleasure, and, by the interposed mechanism, slide the two pinions. One of these toothed pinions works in the teeth of an internal wheel, whilst the other works in the teeth at the periphery of a wheel of lesser diameter, but both these wheels are fixed on the same shaft. There are also two toothed pinions on this axle or shaft, which rotate with, but are capable of sliding on, the ends of this shaft or axle, so that either or both of such pinions may be in or out of gear with spur wheels carried by the two main road wheels. *Patent completed.*

757. E. HARTLEY, J. CLEGG, and T. and J. MELLODEW. *Improvements in looms for weaving.* Dated March 21, 1863.

This invention relates—1, to making the shed in looms. For this purpose, the patentees employ two endless chains or equivalent apparatus, the one acting upon a lever so as to depress it, and the other so as to raise it. These chains are both placed on the same side of the centre motion on which the said lever turns, and act upon the same roller carried thereby. 2, The invention relates to that construction of picking motion of looms in which the lever which is struck by the tappet is moveable, and consists in the employment of an endless chain of tappets or equivalent apparatus acting upon the said lever, whereby the patentees are enabled to vary the number of following picks at each side of the loom at pleasure. *Patent completed.*

758. J. M. HETHERINGTON. *Improvements in machinery or apparatus for combing cotton and other fibrous materials.* Dated March 21, 1863.

This invention refers to that description of machine for combing cotton and other fibrous materials known as Hielman's, and consists in a method of feeding the material to the usual nippers thereof. In the above-named description of machine, this feeding is effected by a pair of rollers, which, by their occasional revolution, convey forward the material, so as to afford a given length to the aforesaid nippers, which then present it to the revolving comb working in conjunction with other rollers, so as to afford a combing of both ends thereof. This invention consists in the removal of the said feeding rollers, and in substituting therefor a reciprocating apparatus, which thrusts the material forward by a rectilineal action, as distinguished from that of rotary surfaces, by which means the patentee is enabled to allow that point which acts upon the material to approach nearer to the usual nippers, and therefore to operate upon fibrous material of comparatively short staple. *Patent completed.*

759. F. APPLEGATE. *Apparatus for making certain indications in railway carriages.* Dated March 21, 1863.

This apparatus consists of a disc mounted on an axis, which disc is caused to rotate by means of a tangent screw, working on a wheel of such diameter as may be necessary in proportion to the diameter of the disc. On the sides of the disc are painted or otherwise indicated the names of the several stations on the line of rails, which names occupy a radial position. *Patent abandoned.*

760. F. APPLEGATE. *Improvements in time indicators.* Dated March 21, 1863.

This invention consists in the application of revolving discs on which to represent the progress of time, instead of hands, as in a clock or watch, such discs being so combined, arranged, and prepared as to show the time as used and indicated in railway time tables, that is to say, by representing the numeral or numerals corresponding with the hour, and also a numeral or numerals indicating the minutes:—for example, 4 hours 20 minutes, instead of by the ordinary clock or watch face and hands. *Patent abandoned.*

761. W. CLARK. *Improvements in the separation or obtaining of ammonia from azoted matters in the preparation of manure.* (A communication.) Dated March 21, 1863.

This invention consists—1, in causing azoted matters to be filtered through suitable substances for retaining and settling the ammonical products in the azoted matters, yet permitting the escape of the liquids after they have been partly or entirely deprived of the azoted compounds contained therein; 2, in retaining and settling or depositing partly or entirely the ammoniacal compounds of azoted matters by means of phosphoric acid in the free state, or partly combined with the bases, so as to produce therefrom acid phosphates, and a salt of magnesia; or more simply by the aid of acid phosphate of magnesia, so as to produce as filtration takes place ammoniaco-magnesian phosphate insoluble in water; 3, the patentee states he may also proceed by precipitation, pouring phosphoric acid or acid phosphates and a salt of magnesia on to the ammoniacal matters; or, acid phosphates of magnesia may be used in order to produce ammoniacal magnesian phosphate above indicated, and allowing it after standing a sufficient time to be separated from the liquid part, which is now of no value on account of its being deprived of the ammoniacal compounds it contained. *Patent completed.*

762. H. HANCOCK. *A new combined range for making gas, cooking by gas, and lighting, especially applicable to ships.* Dated March 23, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

763. J. W. H. and E. J. ROTHWELL. *Improvements in heating the feed water of steam boilers.* Dated March 23, 1863.

This invention consists in placing in the flue or flues, and as close to the bridge of the furnace as practicable, a coil or zig-zag arrangement of pipes, through which the feed water is passed by means of any suitable mechanism. The water is conveyed to the coil or zig-zag arrangement of pipes by a pipe passing either through the ashpit, or from the other end of the boiler to that containing the furnace, and the outlet pipe for conveying the water into the boiler from the said coil or zig-zag arrangement of pipes is passed either through the ashpit, or along the flue in the opposite direction to any convenient part of the boiler. The inventors also pass the water from the coil or zig-zag through a pipe in the side of the flue direct into the boiler. *Patent abandoned.*

764. W. JOHNSTON. *Improvements in apparatus for lighting and heating.* Dated March 23, 1863.

This invention is not described apart from the drawings. *Patent completed.*

765. T. G. GRANT. *Improvements in ovens and apparatus for heating the same.* Dated March 23, 1863.

For the purposes of this invention, an oven is constructed of sheet iron rivetted together, and it is formed with horizontal shelves on the interior, which it is preferred should be of open work, and the front is covered with doors, preferring that there should be doors opposite the space between two shelves, in order that the meat or other food placed in such space may be got at without opening the front of the oven to a greater extent. An oven, such as above described, is fixed within a chamber or case, also made of sheet iron plates rivetted together. The case is of such dimensions as to leave a space at the back and at the two ends, and also over the top and under the bottom of the oven, but the front of the oven is not enclosed by the case. Below the oven is a fireplace, which is arranged in such a manner that the heat and products of combustion pass off between the oven and the chamber laterally, and towards the back, and then rise up to the upper parts of the chamber. It will thus be seen that the oven is contained in a highly heated chamber. At the upper part of this case or chamber is a chimney having a valve or slide to regulate the passage away of the products of combustion. At the upper part of the oven there are tubular passages with valves by which steam and vapours arising from the food which is being cooked may pass from the oven into the outer atmosphere. Provision is made in the outer casing for cleansing the interior of this chamber, and the exterior of the oven, doors being used for this purpose with valves to regulate the admission of air into the chamber by which the heat of the oven can be regulated. *Patent completed.*

766. J. EYLES. *Improvements in cheffonier bedsteads.* Dated March 23, 1863.

This invention consists in so arranging and fitting cheffonier bedsteads, as to contain and present for use all the fittings and utensils necessary for a bedroom. The inventor makes the greater part of the cheffonier to contain a turn-up bedstead, which is enclosed by single or double doors in the front of the cheffonier. The bedstead consists of a suitable frame and sacking, or other suitable bottom, with hinged legs to fall down to support the bed bottom from the floor. This bedstead, as before mentioned, occupies the greater part of the length of the cheffonier, while the other part is occupied with trays or shelves, and is furnished with a door at the end of the cheffonier by which access is had to the utensils contained. The upper tray or shelf is furnished and fitted suitably for washing, a washhand basin being inserted while the ewer may stand on a lower shelf, or it may be placed in the basin as usual, if the height above admits of it. He fits a tray or shelf below so as to slide, whereby it may be removed from below and placed above the basin itself, and form a table on which a looking-glass may be placed; or the looking-glass may be permanently mounted on this shifting shelf which at the same time forms a dressing-table. *Patent abandoned.*

767. W. CLARK. *Improvements in agricultural apparatus.* (A communication.) Dated March 23, 1863.

This invention relates to an improved agricultural apparatus to be used—1, for destroying field mice and all kinds of insects hidden in the ground, as also noxious weeds and vegetation, such as couch, chickweed, crowsfoot and others injurious to agriculture; 2, for scarifying the ground to a depth of 5 in. or more, according to its nature; 3, for harrowing the ground in order to clean it; 4, for crushing or breaking the clods; 5, for ploughing it with a large ploughshare; 6, for ploughing light sandy soils with two, three, or four small shares; 7, for trenching or draining land simultaneously with the ploughing, that is, to form channels of 3 in. or more in depth in the bottom of each furrow for carrying off the water. These channels, which are made when ploughing by the scarifying tines, are immediately covered up by the soil turned over by the mould-board of the plough. 8, It may lastly be used for preparing the ground simultaneously with the ploughing for planting colza. This improved apparatus consists of an iron frame mounted on two hind wheels, and with a fore-carriage also provided with a pair of wheels. The frame is supported by the hind axle, on which are mounted sliding bearings, carrying the travelling wheels; the wheels are regulated in height by means of jointed levers in order that the implement shall penetrate more or less into the ground. This arrangement consists of 3 parts: 1, the lever arm; 2, a ratchet-wheel; 3, a rod which is attached to the bearings carrying the axle. The [illegible] and rod are geared with the ratchet by means of [illegible] mounted on the lever. By this arrangement [illegible] the implements may be adjusted at any requi[illegible]

the ground without stopping the horses. A steering apparatus is placed in the centre of the frame, consisting of a large and small bar, which serves to guide the fore-carriage and frame in any desired direction, especially on hilly or uneven ground, in order to prevent its overturning. The fore-carriage is attached to the framing by the cross bar of the steering apparatus, and by tie rods connected to same, which may or may not be curved at their extremities; the other ends of the said tie rods are fixed to the draw bar. Sockets of the number of 23 are cast on the frame for fixing the various cultivating implements, letters being also applied on the frame indicating the position of each in their respective sockets. By the aid of the several parts above referred to, the inventor may regulate the depth to which the several implements enter the ground, 7 in. being the usual maximum depth, which may be still further increased another 5 in. by raising the wheels with the arrangement of levers and pawls above described. *Patent completed.*

768. H. Cook. *Improvements in the arrangement and construction of apparatus for transmitting electric currents and signals for telegraphic purposes.* (A communication.) Dated March 24, 1863.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

769. J. Reilly and W. Martin. *Improvements in lubricating horizontal shaftings and bearings of all descriptions.* Dated March 24, 1863.

This invention consists in forming the steps or pedestals of horizontal shafting with a recess or box to contain the oil or lubricating matter, so that as the shafting revolves, it will only t... up or use as much of the lubricating matter as is n...ssary for the purpose, and thus prevent the waste so gene...ally complained of. By the term bearings as named in the title, the patentees mean the bearing surfaces of the axles of railway wheels, and the axle boxes, and also the bearing surfaces of the shafts and pedestals of shafts for marine and stationary engines, and also the pedestals and bearing surfaces of all descriptions of horizontal shafting. *Patent completed.*

770. G. Davies. *Improvements in wrappers or papers for needles, and in machinery or apparatus for sticking needles therein.* (A communication.) Dated March 24, 1863.

This invention consists—1, of a strip of paper, or other suitable material, into which the needles are stuck and arranged separately from each other, the paper with its needles being permanently attached to a wrapper arranged for folding over and enclosing the needles. The object of the improved wrapper is to prevent that loss of needles which frequently takes place on removing them from or replacing them in ordinary wrappers. 2, This invention consists of certain mechanism for the sticking of uniform rows of needles in ridges formed on a continuous strip of paper, preparatory to the formation of the above mentioned wrappers. *Patent completed.*

771. S. Healey. *Improvements in the manufacture of zinc, and in the apparatus employed therein.* Dated March 24, 1863.

This invention consists in constructing the furnaces employed in the melting and annealing of zinc in close proximity to each other, so that the process of annealing may be effected by means of the waste heat escaping from the melting furnace. *Patent abandoned.*

772. H. Williams. *Improvements in machinery or apparatus for dressing slates.* Dated March 24, 1863.

According to this invention, it is proposed to employ a horizontal knife or knives working vertically, so as to receive a chopping motion. The knife or knives is or are carried by arms keyed on to a horizontal rocking shaft, supported in bearings fixed to the main framing of the machine. A rapid rocking motion is imparted to this shaft by means of a revolving crank pin carried on the end of the main driving shaft, and working in a slotted lever-arm keyed to the rocking shaft, or by means of a connecting rod worked by an eccentric. The driving shaft is supported on suitable bearings on the main framing, and is provided with the usual fast and loose driving pulleys. The machine is fitted with the usual gauge and travel. *Patent abandoned.*

773. A., J., and J. Topham. *Improvements in the manufacture of ornamental twist lace, and in machinery used therein.* Dated March 24, 1863.

According to the present invention, the patentees lead the bobbin threads sideways by means of warp threads, or threads worked like warp threads, which they call guiding threads; they act together with the ordinary points as they rise, and, when in the working of the machine a portion of the work is arrived at where some of the bobbin threads require to traverse sideways, the movement is effected by these guiding threads acting in such a manner as to cause the bobbin threads to be taken by the points up to the position in the work in which they are required, so that the tissue and the bobbin threads do not have to be moved afterwards as when drag threads are used. *Patent completed.*

774. J. Kirkham. *Improvements in the manufacture of iron and steel.* Dated March 24, 1863.

The object of this invention is to facilitate the conversion of granulated iron ore, obtainable in large quantities from the district of Taranaki, New Zealand, into iron and steel. The difficulty hitherto experienced in the smelting of this granulated ore or sand has been that the blast of a smelting furnace would disperse it, and that it was, therefore, necessary to employ saggers or pots for containing it while submitted to the smelting operation. The cost, however, of these pots prevented the economic use of the ore. Now, in order to effect the smelting of this pure ore of iron, the inventor first melts a portion of pig iron in a cupola furnace, or otherwise obtains fluid iron. This fluid metal he runs into what he terms a mixing furnace, and then applies thereto a suitable quantity of the Taranaki ore, stirring the same well so as to ensure a thorough mixing. The hot metal, acting as a solvent, will take up into combination the granulated ore. A portion of this mixture—say one-half—he now discharges into a puddling furnace, and puddles it in the ordinary manner, modifying the treatment according to the product required to be obtained. The remainder of the iron he returns to the cupola furnace to be reheated in order to render it fit to receive a second dose of the Taranaki or granular iron ore; he then proceeds with the operations as described. *Patent abandoned.*

775. A. J. Cooke. *Improvements in portable "hooka" pipes.* Dated March 24, 1863.

This invention consists in certain improvements in the construction of "hooka" pipes, whereby they are rendered capable of being carried in the pocket while being smoked, the tube only being visible. The inventor proposes to employ a cylindrical flat or oval-shaped vessel of metal or glass, the upper part of which is to be provided with a cap or stopper, through which the stem of the pipe bowl descends into the liquid in the vessel. The short leg of an inverted syphon is fixed in the interior of the vessel in such position as to be above the level of the liquid; the long end protrudes through the top of the vessel, and to this end the flexible tube and mouthpiece are attached. At the bend of the syphon a bulb is formed to receive the narcotic oil resulting from the tobacco. When required for outdoor use, the apparatus may be placed in a case or box of thin metal, having apertures at the top for the admission of air and escape of the smoke, and through one of which apertures the flexible tube is passed, thus ensuring perfect safety to the smoker. *Patent abandoned.*

776. J. White. *Improvements in protecting the surface of the iron and steel of ships and all other structures, except that of cables, tanks, and boilers, while in contact with water, from decay.* Dated March 25, 1863.

For protecting the surface of the iron and steel of ships' bottoms and other structures (except that of cables, tanks, and boilers) while in contact with water, from decay, the inventor fixes on the surface of the iron or steel zinc or aluminium equal to at least 1-16th part of the area of the surface of the iron and steel by means of iron or steel screws, rivets, or nails, taking care that the points of contact of the iron or steel and of the zinc or aluminium respectively are clean when they are fixed together, and that they are fixed in close contact. For preventing or abating, and for facilitating the removal of, foulness of ships' bottoms, and for giving a capacity of increased speed to ships, he covers the surface of the ships' bottoms while dry, by means of a plasterer's trowel or other implement, with a composition made by melting and mixing together equal parts of fat and oil, or about equal parts of fat, oil, and white lead, or one part of fat, two of oil, and three of powdered quick lime, and from time to time, when necessary, having scraped off the foulness, if any, from the ships' bottoms while dry or while afloat, he covers the ships' bottoms, while dry or afloat, again with any one of the said compositions, using for that purpose, when necessary, a diving apparatus, and rubbing on the composition with the hand and using a plasterer's trowel or other implement for spreading it. *Patent abandoned.*

777. M. Phillips. *Improvements in the manufacture of iron or other metallic rod or wire, and in the machinery or apparatus employed in such manufacture.* Dated March 25, 1863.

In carrying out this invention, the inventor takes a cylinder or pipe from 4 ft. to 5 ft. long, bored internally to 2½ in. diameter, or thereabouts, in which cylinder is a solid plunger or piston, worked either by hydraulic pressure, or by means of a crank or otherwise from any suitable machinery. At the opposite end of the cylinder to that which the piston enters a cap of hard cast iron or steel, 6 in. to 8 in. long, is fastened to the cylinder, on the one side by a strong hinge, and on the other side by a hasp, or in any other suitable way, so that the end of the cylinder may at once and with ease be laid open at each back stroke of the piston for inserting the heated billet of metal, and covered with the cap again for the forward stroke of the plunger. The cap is bored longitudinally, the hole tapering from 2½ in., where it fits against the bore of cylinder, to 1 in. at the other end. At the end of the cap a cast steel block or point is screwed in, bored in the same way and tapering, from an inch, to the size required for the rod or wire. The point can be changed in an instant when it is required to change the size of rod. The hot billet comes from the falling furnace out to the required length, in the same way as for the guide rolls, and is pushed into the cylinder, the plunger being then at the other end for the commencement of the stroke. The cap is at once closed and fastens with the hasp of its own accord. The forward stroke of the plunger forces the billet through the taper bore of the cap and steel point; it comes out at the other end a rod in every way better finished than a rolled rod. Close by the point must work a small light pair of shears, worked in the usual way for cutting the rods into the required lengths. At the end of the stroke the rod, if not for wire, must be cut off as close to the point as possible, the cap again opened, and a second billet put in, which not only pushes out the small portion of the first billet remaining in the taper of the cap, but from the great pressure used welds with it and forms one continuous rod. *Patent abandoned.*

778. J. Leach and J. Anderson. *Certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.* Dated March 25, 1863.

This invention relates to all descriptions of machinery for preparing and spinning cotton and other fibrous substances, wherein drawing rollers are employed; and the arrangements consist in the employment and use of front bottom rollers having smooth surfaces or peripheries, in contradistinction to such surfaces being fluted, grooved, roughened, or rendered otherwise uneven, such fluted or uneven surfaces having been regularly employed and considered necessary hitherto; whereas, by the use of front bottom rollers made with smooth surfaces or peripheries, a considerable improvement is effected in the quality of the yarn, the leather coloured top rollers are not injured as by fluted rollers, and the hold upon the fibres or yarn is not diminished. *Patent completed.*

779. J. H. Worrall. *Certain improvements in the method of producing surfaces in imitation of woods, and in printing therefrom.* Dated March 25, 1863.

This invention is designed for the purpose of obtaining fac-simile impressions or representations of woods, by so treating the surface of the wood as to render the natural grain thereof available for transferring or imprinting the pattern upon paper, or other material, the pattern so produced being applicable to imitation graining, paper-hangings, oil-cloths, figuring and embossing leather and textile fabrics, and to other ornamental purposes. The improvements consist in an improved method of obtaining such impressions from the natural surfaces of woods on paper, copper, zinc, or stone, and in transferring the patterns therefrom, and printing them upon surfaces such as paint, wood, stone, metallic surfaces, or textile fabrics, so as to represent the natural grain or appearance of the wood. *Patent completed.*

780. G. Stuart. *Improvements in bleaching jute fibre.* Dated March 25, 1863.

The patentee claims the bleaching of jute fibre by immersing it twice or oftener in a solution of a chloride, each such immersion being followed by an immersion in dilute sulphuric acid. *Patent completed.*

781. C. Monson. *An improved gravitation engine.* Dated March 25, 1863.

In carrying out this invention, the patentee employs two vessels of similar construction connected together by a pipe or tube, and exhausts the air therefrom. He then partially fills one of the said vessels with water, or other fluid, and generates steam within it, which steam will by its pressure upon the surface of the fluid cause it to flow from the vessel so filled with fluid through the connecting pipe or tube into the second vessel; and by employing the weight of the fluid caused by such change from vessel to vessel, or from the second back to the first, he obtains a power which may be used for the various purposes for which motive power is required. *Patent completed.*

782. R. Armitage and C. Senior. *Improvements in means or apparatus for stretching fabrics.* Dated March 25, 1863.

This invention relates to machinery employed in the finishing of textile or other fabrics, known as tentering and drying, in which process it is necessary to stretch or expand the fabrics; and the object of the first part of the invention is to produce or effect uniformity in the stretch or expansion, also any degree or amount as may be required thereon. For this purpose, the patentees apply a roller or rollers at the feeding end of the machine for retarding or holding back the fabrics as they are fed thereto. Such roller or rollers is or are driven at a less or lower surface speed than the rollers and chains or other conducting means by which the fabrics are travelled through the machine, and are capable of more or less speed being readily given thereto, according to the amount of stretch or expansion required. The driving pulley fits loose on the boss of a worm wheel, which is fixed on the retarding roller, but has a worm mounted thereon which gears with the wheel, and forms a clutch or driver thereto. A star wheel is mounted on or geared with the worm, and receives motion or is operated by projecting pins fixed in the orbit of the star wheel, or in its line of travel, thus producing a differential motion. The number of pins to operate the star wheel in each revolution may be varied according to the speed required to be given to the roller or rollers. The second part of the invention consists in applying fingers or levers to press the fabrics on to the tenter hooks or teeth, motion being given thereto by tappets or cams. The third part consists in having the rollers which are employed in conducting the fabric through stretching machines made in two or more parts, telescopically, and arranging them in the machine alternately with thick end and small end to each other, so as to maintain or produce equal lengths of the lists or edges of the fabrics. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 15, 1863.

1491. W. W. Box, Birmingham, engineer. Improvements in fire bars for the boilers of locomotive and other engines, and for fire boxes and furnaces generally.

Dated July 11, 1863.

1739. H. Greaves, Abingdon-street, civil engineer. Improvements in the construction of railways and tramways.

Dated September 11, 1863.

2241. L. Meyer, 36, Rue de Marseille, Paris, glass maker. Improved means of, and apparatus for, employing vapours, gases, and the heat derived from combustible matters.

Dated September 18, 1863.

2300. H. C. Huskinson, Manchester. Improvements in the manufacture of buttons.

Dated September 26, 1863.

2373. L. H. Norris, 6, Upper Bedford-place, Russell-square. Improvements in the manufacture of india rubber and gutta percha compounds. (A communication.)

Dated October 6, 1863.

2443. W., H., and T. Holgate, Accrington. Improvements in the manufacture of pickers used in weaving.

Dated October 7, 1863.

2449. D. Barr, Birmingham, house and estate agent. Improvements in apparatus for regulating and working window blinds.

Dated October 8, 1863.

2463. A. P. Charpentier, Palais Royal, Paris, France, watch manufacturer. Improvements in the manufacture of watches.

2467. W. Lorberg, 4, Wyld's-rents, Bermondsey, analytical chemist. Improvements in the manufacture of gas from tar.

2469. R. G. Watson, gentleman, and W. J. Kendall, mechanic. An improved walking-stick umbrella.

2471. J. Spencer, Doncaster, implement manufacturer. Improvements in machinery for separating different sizes of roots.

Dated October 9, 1863.

2477. G. Parry, Ebbw Vale Iron Works, Monmouth, furnace manager. Improvements in refining crude pig iron and in furnaces connected therewith.

2479. J. Mather, Crow Oaks, near Radcliffe, Lancaster, bleacher, dyer, and finisher. Improvements in friction or glazing calenders.

Dated October 10, 1863.

2485. J. Vaughan, Middlesborough, ironmaster. Improved apparatus for purifying waste gases from blast and other furnaces.

2487. J. Ruthardt and F. Thiele, Oxford-market, Oxford-street. Improvements in apparatus for purifying and increasing the illuminating power of gas.

2491. T. Hughes, Wolverhampton, tin plate worker. Improvements in the manufacture of lanthorns.

Dated October 12, 1863.

2493. P. R. Jackson, Rolling Mills, Salford, engineer. Improvements in the manufacture of hoops and tyres for railway wheels and other purposes, and in the machinery employed therein.

2495. J. G. Hartley, 11, Lawrence Pountney-lane, shipowner. Improvements in the construction of iron and wooden ships and other vessels.

2497. W. T. Bury, Regent Works, Sheffield, steel manufacturer. An improvement in vessels or baths for containing heated metals and fluxes employed in the processes of hardening and tempering steel and steel articles.

2499. T. Gidlow, Heaton, coal proprietor. Certain improvements in bearings for axles for railway or other carriages.

2501. W. E. Gedge, 11, Wellington-street, Strand. Improvements in shears for cutting metals and other substances. (A communication.)

2503. R. Aitken, Cambridge-street, Pimlico, civil engineer. Improvements in the permanent way of railways.

2505. J. J. Anderton, St. James-street, Northampton, currier. Improvements in machinery for cutting and finishing the edges of the soles and heels and the bottoms of boots and shoes.

Dated October 13, 1863.

2507. G. Morgan, 3, Budge-row. An improved "sample" bag for postal and other purposes.

2511. T. C. Craven, Greenbush, New York. Improvements in cotton gins.

2513. J. Fowler, Leeds, engineer. Improvements in apparatus used for hauling agricultural implements.

Dated October 14, 1863.

2515. J. Rowley, Leeds. Improvements in apparatus for washing, scrubbing, scouring, bleaching, and discharging impurities or other matters from woven or other fibrous materials.

2517. E. P. Colquhoun and J. P. Ferris, 1, Lawrence Pountney-hill. Improvements in fire-bars for the furnaces of steam boilers, and the mode of mounting the same.

2519. J. Milton, manager, Paisley. Improvements in looms for weaving.

2521. O. E. Sonnenstein, Circus, Minories. Improvements in reflecting apparatus. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated October 14, 1863.

2522. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. An improved apparatus for cleaning ships' hulls. (A communication.)

Dated October 17, 1863.

2546. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in washing machines. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, October 27, 1863.

1480. J. Hopkinson. Fastening the ends of metal bands.

1481. W. N. Hutchinson. Apparatus for cleansing ships' bottoms and sides.

1497. T. Petitjean. Glass.

1498. R. W. Gordon. Spinning flax.

1501. J. J. Shedlock. Valves for the passage of steam, gas, and fluids.

1508. J. Steele and W. Mason. Removing the bran or outer skin from wheat and other grain.

1509. A. J. Fraser. Apparatus applied to house and carriage window sashes for working and fastening thereof.

1511. J. C. Onions. Smith's and other bellows.

1512. R. A. Brooman. Protecting or preserving the silvering or quicking on glass. (A communication.)

1514. J. Banwell. Machine for collecting and elevating into a waggon, hay, corn, or other agricultural produce.

1516. J. Newnam. Boiling in vacuo at low temperature.

1525. J. L. Ganne. Toy-pistols.

1531. E. Gossiaux. Machine for making bolts, rivets, &c.

1537. A. Morel. Combing wool, &c.

1538. A. Morel. Traction engines.

1545. D. D. Kyle. Baths.

1551. J. L. Clarke. Turning over the leaves of music.

1555. W. L. and T. Winans. Steam vessels.

1556. W. L. and T. Winans. Couplings for propelling shafts of ships or vessels.

1557. W. L. and T. Winans. Propellers.

1558. W. L. and T. Winans. Propellers.

1563. A. Twaddell. Sizing or preparing warps.

1565. W. Snell. Arrow-shaped projectiles and guns. (A communication.)

1568. W. Rowan. Pistons.

1570. W. L. and T. Winans. Adapting propellers for propelling ships or vessels.

1571. W. L. and T. Winans. Propellers for propelling ocean steam vessels.

1572. W. L. and T. Winans. Engines for actuating the propelling shafts of steam vessels.

1573. W. E. Newton. Printing machinery. (A communication.)

1578. W. W. Sleigh. Obtaining motive power.

1581. R. A. Brooman. Breech-loading arms. (A communication.)

1582. W. L. and T. Winans. Steam boilers.

1584. W. L. and T. Winans. Superheating steam in steam boilers.

1585. E. Brooks. Breech-loading firearms.

1589. S. Knowles and R. Hayward. Plaiting and measuring woven fabrics.

1603. W. Kirrage. A new and improved cloth for floors, roofs, walls, tanks, and other linings.

1608. T. Tulpin. Stretching and drying fabrics. (A communication.)

1609. W. Clark. Apparatus for aërating liquids. (A communication.)

1620. W. Andrews. Insulating electric telegraph wires.

1631. S. Cole. Clasps or fastenings for securing brooches, solitaires, and other dress ornaments.

1646. R. A. Brooman. Protecting metals and metallic articles from oxidation, and for coating slate, bricks, pottery, and ceramic ware. (A communicaton.)

1647. A. A. Croll. Purification of gas for illumination.

1656. C. Baulch. Boots and shoes.

1681. C. Schiele. Turbines.

1720. A. R. Johnston. Portable fence for sheep and cattle pens, or for other enclosures.

1721. M. A. F. Mennons. Preserving and protecting the silvering of mirrors. (A communication.)

1751. P. C. A. Jodocius. Fishing, and the apparatus or means to be employed therein. (A communication.)

1773. M. Henry. Figuring, ornamenting, and colouring fulled and felted fabrics and articles. (A communication.)

1816. F. Ayckbourn. Air and water beds, pillows, bolsters, and cushions.

1892. W. and J. Graham. Looms for weaving.

2008. C. Schiele. Fans, pumps, and machinery for propelling air fluids or other substances by centrifugal force.

2041. R. Baillie. Reefing or furling the sails of vessels, and in the apparatus to be employed therein.

2401. J. Mackay. Firearms, ordnance, and projectiles.

2413. J. E. F. Lüdeke and M. Fischer. Motive power.

2415. J. Tees. Packing for stuffing boxes and pistons.

2433. J. M. Guilmette. Substitute for whiting, pipeclay, and other analogous substances to be employed to produce a white coating or surface.

2459. J. Gibson. Cast-iron pit tubing.

2499. T. Gidlow. Bearings for axles for railway or other carriages.

2546. J. H. Johnson. Washing machines. (A communication.)

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed October 23, 1863.

1022. J. Cornes and J. C. Davis.
1033. J. P. and E. B. Nunn.
1050. M. Valkenhuyzen.
1056. W. Hudson and C. Oatlow.
1061. S. Crabtree.
1062. G. Hall and J. Wells.
1063. A. Kinder.
1069. T. Moore.
1077. W. Tarr and E. Farr.
1079. E. and F. A. Leigh.
1082. M. Barland and E. H. C. Monckton.
1087. J. Wibberley.
1092. C. P. Stewart and J. Kershaw.
1093. J. Appleby.
1097. W. Clissold.
1098. W. G. Craig.
1104. J. Purdey.
1107. J. T. and T. Oakley.
1133. G. Davies.
1172. J. Burrell.
1174. J. Burrell.
1200. H. Wilde.
1367. L. S. Chichester.
1758. J., G. T., and F. R. Holmes.
1782. H. Elliott.
1791. N. Thompson.
1962. J., J., A., and W. Thornton.
2072. W. E. Newton.
2226. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2566. E. W. Hughes.
2578. W. H. Tylor.
2582. R. Baynes.
2584. C. Lungley.
2597. J. and G. Chisholm.
2605. H. Cook.
2610. W. Sharp.
2612. T. Cobley.
2618. W. Syrett.
2634. W. E. Newton.
2643. T. Greenwood and J. Dockray.
2677. J. Bettyes.
2682. W. Clark.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2480. G. Erman.
2530. J. Armstrong.
2545. P. Fairbairn and R. Newton.
2576. S. Tearne and G. W. Richmond.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending October 24, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
521	0 4	532	1 0	543	0 4	553	1 4	563	0 4	573	0 4
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523	0 4	534	0 8	545	0 4	555	0 4	565	0 4	575	0 8
524	0 8	535	0 10	546	0 8	556	0 4	566	0 4	576	0 4
525	0 4	536	0 4	547	0 8	557	1 0	567	0 6	577	0 8
526	0 4	537	0 6	548	0 4	558	0 10	568	0 8	578	0 4
527	1 0	538	0 4	549	0 10	559	1 0	569	1 4	579	0 4
528	0 4	539	0 10	550	0 4	560	0 10	570	0 8	580	0 8
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* Disclaimer and memorandum of alteration (1857).

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LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	pr ct
IRON:—									
Welsh Bars, in London	per ton	7	10	0	to	0	0	0	2½
Nail Rods	do	8	0	0		8	10	0	
Hoops	do	10	10	0		0	0	0	
Sheets, single	do	11	10	0		0	0	0	
Staffordshire Bars	do	9	10	0		0	0	0	
Bars, in Wales	do	6	10	0		6	15	0	
Rails	do	7	0	0		0	0	0	nett
Foundry Pigs, at Glasg, No 1	do	3	0	0		3	6	0	
Swedish Bars	do	11	10	0		12	10	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		16	10	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	105	0	0		0	0	0	3
Hammered Bottoms	do	115	0	0		0	0	0	
Flat Bottoms, not Hamrd	do	110	0	0		0	0	0	
Tough Cake and Ingot	do	98	0	0		0	0	0	
Tile Copper	do	98	0	0		0	0	0	
Best Selected	do	101	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	0	
Fine Foreign	per ton	100	0	0		102	0	0	
TIN:—									
English Block	per cwt.	5	15	0		0	0	0	2½
do Bar	do	5	16	0		0	0	0	
do Refined	do	6	0	0		0	0	0	
Banca	do	6	3	0		6	3	0	nett
Straits	do	5	17	0		0	0	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	9	0		1	10	0	
Second Quality	do	1	7	0		1	8	0	
Coke	do	1	3	6		1	5	0	
SPELTER:—									
On the spot	do	18	7	6		18	10	0	nett
ZINC:—									
English Sheet	do	24	0	0		0	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	34	0	0		0	0	0	2½

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.		£	s.	£	s.
Teak ... load	£12	0	£13	0	Archangel, yellow	£13	0	13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
„ yellow pine	3	10	4	10	Finlan	9	0	10	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	15	0
Quebec oak, white	5	10	6	10	Gothenburg, yellow	10	0	11	0
„ birch	3	10	4	10	„ white	9	0	9	10
„ elm	3	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderhamn	9	10	10	0
„ fir	2	10	3	10	Christiania, per C., 12ft. by 3 by 9 in.				
Memel fir	3	5	3	10					
Riga	3	0	3	5	Christiania, yellow	21	0	23	
Swedish	2	10	2	15	Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	0
Masts, Quebec red pine	5	0	6	0					
„ yellow pine	5	0	6	0	PUMICE STONE pr ton	5	10	9	0
Lathwood, Dantzic, fm	5	10	6	10	**OILS, &c.**				
„ St. Petersburg	8	0	8	10	Seal, pale ... per tun	46	0	0	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	78	0	80	0
					Cod	56	0	58	0
					Whale, Sth Sea, pale	45	0	46	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	59	0	60	0
St. John, white spruce	14	0	15	10	Cocoanut, Cochin	47	10	0	0
Yellow pine, per reduced C.					Palm, fine	36	0	38	10
					Linseed	42	15	43	0
Canada, 1st qual.	17	0	18	0	Rapeseed, Eng. pale	42	10	43	0
„ 2nd do.	11	0	12	0	Cottonseed	31	0	35	0

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THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 6, 1863.

RIVER STEAMERS.

THE danger and inconvenience arising from the enormous traffic which chokes City thoroughfares, and fills the great arteries of London with a nearly solid mass of cabs, waggons, omnibusses, and drays, have for some time attracted the attention and excited the fears of those best acquainted with the subject. These gentlemen dread that the time is not very distant, when all commercial transactions which depend on facilities for City transport, will be brought to an end. The apprehension is not ill-founded. Two principal thoroughfares are already blocked for eight hours out of the ten which constitute a working day; and the municipal executive, bestirring itself now, as it should have done months if not years ago, has established a novel code of City traffic regulations intended to mitigate the evil. For its provisions we must refer our readers to the daily papers. Whether it will have the proposed effect or not remains to be seen. The probability is, that it will for a time relieve our overcrowded streets; but the trade of London extends yearly; and the consequent annual increase in the number of passengers, and tons of merchandise, conveyed through its great thoroughfares is something enormous. Our railway companies gradually bring their lines nearer and nearer to one great centre, which they are ever approaching without reaching. Perhaps the centralization at which they aim is not desirable. Just now, however, the daily interchange of goods and passengers between the termini, instead of being diffused over a considerable region, is concentrated in the heart of the City—within a district, in fact, whose narrow streets, relics of the past, are already overburdened with the legitimate traffic due to the commercial transactions of the metropolis of which they form part. It is, therefore, difficult to believe that any bye-law, however admirable its provisions, can prove of permanent service. Nothing of the kind can strike at the root of the evil. Cheapside and Cornhill, Ludgate-street and the Poultry, are overcrowded, not because the traffic through them is too great, but because they are, from their small width, quite inadequate to supply a demand which has grown up with an age, whose progress has left them far behind. Bye-laws which propose to relieve these streets, principally operate by excluding certain vehicles during particular hours, to the great inconvenience of one portion of the public, without conferring any great benefit on the rest. In truth, the area of land available for roads is insufficient. We have been compelled already to burrow under London; and the extension of a principle, unobjectionable were it but admissible under the conditions, is matter for daily thought and calculation among engineers and capitalists. The Metropolitan Railway was, beyond a doubt, a step in the right direction; but though very convenient, it cannot be said to have in any way relieved the City of its all-but-unsupportable burden. Facilities for transport usually increase the demand which they are intended to supply; and, therefore, any scheme which proposes to aid intercommunication in the London district, must be on an immense scale, comprehensive in its provisions, and able to cope successfully with an enormous amount of work. The mere extension of metropolitan railways, admitting for the moment that engineers and contractors could successfully fight their battle with colossal sewers and ricketty foundations, cannot alone do much good. London requires more highway and by-way room, and every thoroughfare which can be pressed into the service with propriety should take its share in the work of transport.

In the Thames we have a highway no longer "silent," running east and west in the immediate neighbourhood of, if not in the closest proximity to, the most crowded commercial districts of London. Dividing the great city into two portions, its waters flow within a few hundred yards of those streets, choked and obstructed by a plethora of trade, which it is the paramount object of civic desire to relieve. The number of steamboats plying on this river, and the thousands of passengers who daily avail themselves of their services, are sufficient evidence that we have at our command an important auxiliary to any system of metropolitan railways, capable, under proper arrangements, of accommodating an enormous traffic. But, unfortunately, the Thames is not as popular as it should be. Certain redolent mists have hitherto hung about it, which the metropolitan main drainage will, we trust, soon remove for ever to the regions of Barking-creek or Crossness. Then the landing stages and stairs are hardly all that we could desire; while the approaches to them are so thoroughly bad, that we may regard the river as being, to a considerable extent, isolated from the City through which it flows. And lastly, there is no real accommodation for a considerable traffic in the shape of handsome and commodious river boats.

The magnificent inland waters of the Western Continent afford the only existing example of the full development of the system of river navigation. The floating palaces of the Ohio or the Mississippi would be equally out of place and unnecessary on such a river as the Thames. To vessels, 300 ft. long, and over 40 ft. out of the water, the Thames would be a mere dock. But the river boats of North America are worthy of imitation in one respect at least. The accommodation provided for passengers is everything that the most fastidious can desire. Roomy decks and immense saloons, are by no means essential to the comfort of those who travel by water, although they are concomitants to that desirable end, worth securing at a considerable price; and there is no difficulty whatever, or at least there should be none, in constructing steamboats intended to ply for hire on the Thames as the existing boats do, which should embrace every desirable feature of those vessels of which Brother Jonathan is so justly proud, yet without in any way exceeding the dimensions which experience has proved to be best adapted to the river on which their days would be spent. The wretched little steamers at present on the river, fail to supply any legitimate requirement. Their decks are dirty and crowded in the summer months; while, in winter, their dingy cabins are wisely eschewed by a discriminating public. A superior class of vessel would supply and augment an existing demand. Fitted with handsome saloons, erected on a deck, the full breadth of the boat over the sponsons—if the paddle wheel was retained—excellent accommodation would be provided for all classes in the most inclement weather; while the hull beneath, altered from the form which now obtains, but little increased in size, and no longer required for other purposes, would supply ample room for engines and boilers, powerful enough to secure a speed greater than anything heretofore attempted on the river. It is more than doubtful, however, that the best means of propulsion would be found in the paddle-wheel. In a situation where the greatest facilities for manœuvring are all but indispensable, we conceive that twin-screws could be employed with the greatest possible advantage. They would permit the adoption of a peculiarly formed hull admirably adapted to secure the stability which would be, to some extent, endangered by the out-board saloon deck; and as the depth of the water would allow of the use of screws, 6 ft. or 7 ft. in diameter, the engines would exert their power to much greater advantage through their agency, than by means of a paddle wheel only twice or thrice the size. If, however, it should be deemed expedient to retain the paddle in active service, provision should be made for steering the boat at each end, so that turning would be rendered unnecessary. This, however, involves a form of hull bad for speed, requiring much power to propel it, and altogether objectionable in various other ways. The saloons on deck, should be handsomely fitted up with plate glass, cushioned seats, &c., desiderata which entail very little expense.

In a few years, we trust to see the Thames Embankment scheme carried out as it should be; while the roadway, which it will form the substructure, will make a magnificent esplanade. The river, cleared of its noxious constituents, will most likely be accessible by a series of landings superior to anything which has gone before. A fleet of steamboats, at once commodious, clean, swift, cheap, and easily reached, without the necessity for invading questionable lanes and alleys, could not fail to be popular, more especially during the summer months. The Thames can scarcely be said to have hitherto taken its share of London traffic; and it is time that it began. Less than two centuries ago, its waters formed the main artery of communication through the City and Westminster. Some philosophers state that all things occur in a natural cycle of events. If such be the case, we confess we shall not be sorry to see Old Father Thames take part once more in any scheme which proposes to aid and facilitate that traffic which has become inseparable from the commercial wealth of the metropolis.

STEAM FIRE ENGINES.

IN another of our pages will be found the concluding portion of the Paper on "Steam Fire Engines and the recent Trials at the Crystal Palace," read by Mr. Roberts before the Society of Engineers, on the first Monday of last month. The discussion which followed we deem it best not to publish, as very little information, valuable in a general sense, was imputed by the speakers. The society is comparatively recent in its establishment, and its members are, for the most part, young men, who have scarcely yet learned that moderation strengthens argument, while personalities are out of place in scientific discussion. We must remember, however, that they represent the future generation of eminent engineers; and we feel little doubt that their proceedings will in future display that talent, good taste, and gentlemanly feeling, which have heretofore distinguished them. It is but just to say that the discussion was not confined to the members of the society. As to the merits of Mr. Roberts' Paper, our readers can judge

selves. It was got up with some care, and contains much useful information. We wish the discussion had been equally valuable.

The steam fire-engine question is, comparatively speaking, a thing of yesterday. Years ago, it is true, such machines had not only been proposed, but called into existence both here and in the United States; yet, until the trials of last year, brought the subject prominently before the world, very little was known of their requirements or relative efficiency as compared with the hand engines, on which we had before been entirely dependent for the safety of our streets and warehouses. Of the competition at Sydenham last summer, it is not our intention to speak. The subject has received sufficient ventilation. Even admitting every objection which can be urged against it, it yet served an admirable purpose, in that it demonstrated the facility with which thoroughly efficient machinery could be produced by those who devoted their attention to this department of mechanical construction. The three days' proceedings at the Crystal Palace were, in addition, the direct cause from which the publication of a considerable amount of valuable information resulted. The detached manner in which this was brought before the public seriously detracted from its usefulness; and the literature of the steam fire engine is meagre in the extreme. A lucid, comprehensive, and impartial treatise has yet to be written, and, if properly prepared, it cannot fail to prove serviceable.

In the steam fire engine, more particularly when intended for service on land, we have a machine which must satisfy many strictly exceptional requirements. In order that it may be useful and admirable in the fullest sense of the terms, it must not only be extremely light and portable, but of enormous strength as well. Intended to work under the most trying circumstances, and at seasons when the calmest pulses are accelerated, and the coolest heads lose their self-possession, it must be prepared for rough work and much knocking about. Nothing but first-class workmanship and materials can reconcile these incompatabilities. Ere long, we trust to see steel take the place which wrought iron now holds in the fire engine. It is already partially used, in the form of piston rods and crank shafts; and there is nothing to preclude its employment in the shape of boiler shells, and carriage frames. In cylinders and pumps, the use of homogeneous metal or malleable cast iron, would effect a very considerable reduction of weight, and positively add to their powers of endurance. The principle of annealing articles of cast iron required to sustain great strains, is better understood daily; and a steam cylinder or pump valve, one-fourth of an inch thick, so treated, is stronger than one of twice the weight left as it comes from the moulder's flask. By these means alone, we do not doubt that an important reduction might be effected in the weight of future engines; whilst improvement in the arrangement of the working parts, frames, and trusses, would permit a more equable distribution of the strains to which the machine is exposed, and materially add to its longevity.

The principles involved are simple enough. In their adaptation to the requirements of practice lies the difficulty. Steam gives out its useful effect equally well, whether a piston moves fast or slow, so long as economy of fuel is not an object of desire. Hence, if weight were not a consideration, the speed of the engine would be a matter of slight importance, and that velocity best adapted to the description of pumps employed, could be adopted without hesitation. In order to secure portability, however, in the highest degree, with a pressure kept within reasonable limits, quick-working engines are indispensable. This would, of course, entail no difficulty were the motion of water as manageable as that of steam. Unfortunately this is not the case; and, as a consequence, the steam fire engine, requires to be treated more as an hydraulic than as a steam machine. We are, therefore, inclined to prefer that principle of construction which permits a long stroke of the steam, and a short stroke of the water pistons. Such an arrangement is, perhaps, more likely to secure a high co-efficient of useful effect in proportion to the fuel burned and the weight of the machine, than any other. High-speed engines coupled directly to the pumps, are quite capable of doing good service, as our American friends have showed; but we imagine, with a very considerable and unnecessary waste of fuel. Were it not for the effects produced by wear, the rotary pump, as adopted in the "Manhattan," would seem to be best of any; and it is quite possible that this objection may not be found insurmountable. Notwithstanding a bad boiler, the admirable qualities of that machine, in everything concerning the engine and pump, were sufficiently manifest. We believe that excellent results would be obtained from a similar arrangement supplied with steam by a generator, say on Mr. Field's principle, of sufficient power. The rotary pump, however, is condemned for the present by those best acquainted with its capabilities; and it is, therefore, unnecessary to dwell further on its merits or demerits. That the best possible results have yet been obtained from the reciprocating pump is uncertain; and on the relative good qualities of those varieties employed by the three or four firms, in whose hands the manufacture of fire engines rests for the present, it is impossible to decide. We cannot separate the efficiency of the engine from that of the pump, as no diagrams have ever been taken from the cylinders of a steam fire engine. We fancy that the application of a Richards' indicator during the late trials would have produced some singular results, and afforded much valuable information. No careful or accurate estimate can possibly be made of the relative actual horse-power of the various machines exhibited. Everything stated on the subject is, in the absence of the necessary data, vague to a degree; and we are really as much in the dark as ever in all that concerns pumps and engines in their individuality.

As to boilers, that which supplies the greatest quantity of steam with the smallest consumption of fuel is not necessarily the best. The less coal burned, the less the wear and tear of tubes and fire-boxes, of course; but this is a secondary consideration, of little importance if weighed against the facility for getting up steam to high pressures in short spaces of time, and great capabilities for supplying it in quantities. Still a generator of the class required, may possess great steaming powers, and yet not make an excessive demand on the coal supply. It is a mistake to restrict the quantity of water too much. It is true that the number of gallons contained within a boiler, measure pretty accurately the proportionate time required for raising steam in different engines of nearly similar construction and dimensions. But spread it as thinly, and subdivide it as much as we may, the quantity of liquid measures the heating surface as well as the time. A few hundred additional cubic inches of water space, may frequently prove of the utmost advantage, while their presence cannot do harm. Too much importance is attached to the question of raising steam quickly. Only in cities and large towns will steam fire engines ever find a legitimate opening for the display of their powers. Gas can be had at a moderate price all over England—in every town almost which can boast a few thousand inhabitants; and it is certainly injudicious to endanger the durability of boilers which may be severely tried at almost a moment's notice, by a reduction in the quantity of water carried, when a gas jet may be kept burning in the fire-box night and day at a trifling expense. This system has been adopted at Watling-street station for some time past with great advantage; steam being usually maintained steadily at 5 lbs. on the square inch night and day. Messrs. Lee and Larned constructed some steam fire engines at one time which got 30 lbs. steam in 3½ min. Experience soon showed, however, that there was really no need for such expedition, and the time was extended to 6 min., and finally to 8 min., with a corresponding increase in the good qualities and general efficiency of the machine. Mr. Lee states that one of these 8 min. engines attended 170 fires, never being late but once, when the conflagration took place in close proximity to the engine-house; the steam being always raised from cold water while proceeding through the streets. Pressure is always unsteady with a limited water space, rising and falling with the most trifling variations in the state of the fire.

A great difference of opinion exists as to the relative merits of the horizontal and vertical arrangements of steam cylinders and pumps. We attach little importance to the question. It is, after all, merely a matter of constructive convenience, or the reverse. The great objection urged against the vertical system is, that it produces oscillation. This may be true; but engines on the horizontal plan are open to it as well—the vertical pitching motion is exchanged for one fore and aft; and as it is more difficult to scotch wheels effectually, than it is to run down clamping screws on the springs, we think the advocates of the vertical principle have slightly the advantage. Careful balancing will do much to remedy this evil in either case.

The importance of a steady speed, be it fast or slow, in any system of pumps intended to force water under great pressure, is well known. Our fire-engine builders do not appear to attach as much importance to it as they ought. A good governor would secure the desideratum far better than any manual attention. Serious injury is often done by an engine racing suddenly, on first opening the regulator, or on the bursting of a hose, or a failure in the water supply. The governor would prove an effectual remedy. If the centrifugal form is deemed objectionable, there are many others open to our adoption—a modification of Pitcher's governor, for instance, might probably be used with great advantage. These are, however, minor matters; and as we have good reason to be satisfied with the progress made in the last few years, we may safely leave this consideration, for the present, to those most interested. The necessity for a fly-wheel and crank-shaft is a more important question, on which great difference of opinion exists. We believe that its adoption simplifies the valve gear, gives steadiness to the motion of the engine, and permits a considerable reduction in the space occupied by the machinery—advantages not to be lightly sacrificed.

THE GREAT GUN QUESTION.

How to construct a gun of sufficient strength to fire heavy shot with heavy charges, and with accuracy at short or long ranges, is the artillery problem of the day. Strength of material and structure is the object eagerly sought by Ordnance authorities and projectors. Sundry and various are the devices to attain that end. Some contend that the coil system, in spite of the Armstrong failures, is the *ne plus ultra*; homogeneous iron is the *panacea* of the Whitworth school; cast steel is the hope of those who believe in Krupp; several varieties of built-up and strengthening systems, comprising the Blakely, the Lancaster, the Haddon, and the Lynall Thomas, have ardent advocates; the steel tube, cased in cast iron, is the latest invention, to which Parsons and Palisser are rival claimants. Among so many plans, no wonder the Ordnance Select Committee are puzzled which to choose. But plain cast iron is again holding up its head. The excellent quality of the old carron metal is remembered. Since the days of its celebrity, still further improvements in cast iron have been made, and a strong feeling prevails with some makers of cold blast pigs, that they can produce refined metal of a quality which will surpass all other kinds of iron, and be superior even to steel for heavy ordnance.

Strength of material, no doubt, is of the highest importance; but what has suddenly given to it so much prominence? It is the discovery recently made of the destructive effects of the forcing system of rifling. That vicious method of giving accuracy and range to guns, entails the necessity of an enormous addition to their strength and weight as well as to their cost.

Mr. Anderson, the talented superintendent of the gun factory at Woolwich, to whose mechanical skill Sir W. Armstrong is mainly indebted for the progressive improvements and perfection of workmanship in his guns, informs us that the systems of rifling hitherto employed "necessarily cause a straining on opposite sides of the gun tending to open it and break the metal."

It will be a curious, and not unprofitable study, to trace the action and the result of firing the Armstrong gun. I mean the polygroove rifled 110-pounder breech-loader, loaded with lead-coated cylinders—I don't know that the shunt is better or worse; but to avoid misapprehension, I explain that I refer to the former.

There is no windage; the projectile, being of greater diameter than the bore, offers immense resistance before it is forced through the rifling, so that the powder explodes with tremendous power; but so great is the friction, that the result is an initial velocity of 1,260 *ft. in a second*. The 68-pounder smooth-bore, with a windage of 5 per cent., gives the shot an initial velocity of 1,580 ft. in a second. The difference in velocity being 380 ft., there is a clear loss against the rifled Armstrong of 25 per cent. in propelling force. If we diminish the windage of the smooth-bore to 2 or 1 per cent. of the area of the section of the bore, we obtain an initial velocity of 1,800 to 2,000 ft. in a second, which makes a difference of 600 to 800 ft. in comparison with the performance of the Armstrong, and increases the loss of useful effect to 50 or 70 per cent. These figures speak volumes, they show at what an enormous loss, not only of money but of fighting power, the Government has adopted the Armstrong monopoly.

Here, then, we have the true solution of the immense strength required for rifled ordnance. Regarding the Armstrong gun as the actual embodiment of the worst points of a defective system of constructing artillery, we are naturally led to ask—What is the Armstrong system?

This the country, which has bought the system at the price of nearly three millions, have a right to know. The question is a complicated one; the solution not easy. It embraces many considerations; but, like other complicated questions, the best way of solving it is to show, by the exhaustive process, what the system is not.

It is not the coil principle, for that was invented and applied years previous to Sir William's first experiments in artillery. Before that period it was practically carried out by Professor Treadwell in America, and advocated by Mr. Longridge, C.E., and Captain Blakely, R.A., so that Sir William can lay claim to the initiative neither of conception or execution. It is not the breech-closing hollow screw, providing for the introduction of the charge through it at the rear of the gun, since that plan was one of the earliest adopted for breech-loaders. Nor is it making guns of wrought iron, or any particular method of building-up and strengthening the structure, for built-up wrought-iron guns were proposed and made centuries ago, and at intervals since then.* As a proof that he has no constructive system of his own, he has changed the combination of materials in his guns more than once, and even now he is far from satisfied he has adopted the best. From time to time it has eked out that new improvements in the building-up process have been introduced or proposed. His system is not the lead-coated shot compression plan of rifling, for that Sir William copied from Wahrendorf as he copied other parts of his gun from other inventors.

Can the moveable vent-piece be said to be the Armstrong system? It is by no means clear that the conception of that plan is the original offspring of his mind. The particular mode of its application he may probably lay claim to; but there can be no doubt that the vent-piece is the most faulty part of his heavy guns. Its weight for the 100-pounder is so great, nearly 2 cwt., that it requires two men to lift it in and out, and they find the operation excessively hard work. As a remedy, the side-wedge principle has been introduced; but this also has proved a failure. The escape of gas through the fissures, between the wedges, is so considerable, as to cause great waste of explosive force and rapid deterioration of the gun, to the extent of an alarming increase of danger of its bursting at the breech. The Parliamentary Ordnance Committee, appointed to examine into the Armstrong system, has been puzzled to determine what it is. After taking the evidence of the highest artillery authorities and the most eminent ordnance engineers, as the *resumé* of the answers to nearly 6,000 questions on this point, the Committee came the conclusion thus tersely expressed in their Report:—"This combination of construction, breech-loading, rifling, and coating the projectiles with soft metal came to be viewed as the Armstrong system." That is to say, they do not venture to affirm that this wholesale piracy of other men's ideas, is the the Armstrong system, but it *came to be viewed* as the system which has cost the country three millions.

What, then, is the Armstrong system? It is not, as we have shown and the Ordnauce Committee admits, any peculiarity in any part of the gun; for none of them, unless it be the vent-piece, the most defective part of the structure, is of his invention. That system is something independent of construction; it is an *idea* in his mind to which he would make any kind of gun subservient.

This predominating idea is "great projecting force combined with accuracy and long ranges with heavy projectiles and low charges fired from a rifled gun." To accomplish that *idea*, any gun which will carry it out, is good, in Sir William Armstrong's estimation, whether it be a "polygroove" or a "shunt," a muzzle or breech loader, or any other system. But the gun must be rifled and have little or no windage, in order to realize his idea of obtaining long range and increased intensity of explosion with low charges.

This idea has betrayed its author into the errors and failures of his so-called system. It has led him to abopt modes of rifling which are pre-eminently on the forcing plan, tending to "open the gun and split the metal;" and which cause an enormous waste of power by friction, as proved by the reduction of initial velocity, notwithstanding the increased energy of the explosive force.

To carry out his system, he relied on the the theory of momentum as the measure of propelling force. He calculated that, under all circumstances, the effect of projectiles would be in the ratio of the square of the velocity multiplied by the weight, and he inclined to the belief that, for smashing, if not for penetrating effect, weight would be more valuable than velocity. That such was the conception of his mind, I am warranted in asserting, by the earlier dispositions for the experiments with his gun at Shoeburyness. For the assaults on the "Warrior" and Iron Plate Committee's targets 200-pounder shot, fired from the 100-poonder gun, figured prominently in the programmes. The *Times*, the faithful exponent of Armstrongian vaticinations, exultingly dwelt upon the destructive effects of the tremendous 200-pounders. The gun, in those days, was always spoken of as a 200-pounder. When the trials came off, those heavy missiles were fired singly, and in salvos, at the armour-plates, but their performance was a *fiasco*.

To illustrate the view here presented of the real character of the Armstrong system and the cause of its break-down, I give the following data, which would long ago have been known if Government had allowed the reports of the Iron Plate Committee to be published, but they would not, and we may guess the reason why:—

Results of firing at the "Warrior" and Committee's targets at Shoeburyness.

Gun.	Weight of projectile.	Powder charge.	Velocities.
68-pounder smooth bore ...	68 lbs. ...	16 lbs. ...	1,580
100 " Armstrong rifled	110 lbs. ...	14 lbs. ...	1,200
100 " " "	200 lbs. ...	10 lbs. ...	900

Multiplying the squares of these velocities by the weights of the projectiles respectively, the following quantities work out as the momentum or force of the projectiles:—

68 lbs. shot	169,755,200
110 lbs. shot	161,051,000
200 lbs. shot	162,000,000

According to theory, these figures show that the forces are about equal; but in practice, the results, measured by indentations into the plates, were as follows:—

	inches.
68-pounder, mean indentation...............	2·35
110 " " "	1·75
200 " " "	·85

The conclusions to be drawn from these figures are inevitable. Practice has demolished theory. The heavy projectiles, with light charges, are beaten by the light projectiles

* M. W. Pole, F.R.S., and member of the Iron Plate Committee, has, in an interesting letter to the *Times*, given a description of two built-up wrought-iron bombardes still in existence at Mont St. Michel, in France, which were constructed more than 400 years ago.

with heavy charges. The old 68-pounder smooth-bore has driven the rifled Armstrong out of the field. The *Times* still, however, bolsters up its *protegé* although quite aware of the break-down of his system. It piteously exclaims, "but these are the results at 200 yards," and then, referring to long ranges exceeding 1,000 yards, audaciously declares "that if our experiments at home have not deceived us, Sir William Armstrong would knock the American 'Monitors' to pieces." How ludicrous and dishonest is this assertion, when it is known, and has been reported by the *Times*, that the experiments referred to prove that, at 200 yards' range, Armstrong guns make only slight indentations on armour plates, and produce no destructive effects whatever on the structure which they protect.

How long will the leading journal thus stultify itself, and deceive the public with the cuckoo cry of "Armstrong," after it has become notorious that his system is founded on a fallacy and is utterly worthless!

A correspondent of the *Times* quotes, from the Report of the Ordnance Select Committee, evidence of the Duke of Somerset to the effect that shot weighing 69 lbs. have been fired from the Armstrong rifled 110-pounder with the service charge (16 lbs.) of the 68-pounder smooth-bore, and that the initial velocity of the projectile so fired was greater than that of a 68-pounder. This result was obtained; but in artillery circles, it is well known the thing was abnormal—in fact, what the French call a *tour de force*. This ally of Sir William Armstrong omits to mention some facts which destroy the conclusions he wishes should be drawn from the experiments in question. The 16 lbs. charge was a straining charge which the Armstrong 110-pounder could not stand. Even the original service charge of that gun (14 lbs.) is too great; an order has been issued reducing it to 12 lbs. It is, then, a false pretence to adduce this evidence as proof that the 110-pounder can be used at short ranges with the same effect as the 68-pounder, or, in fact, that it can be fired at all in actual service. The comparison of initial velocity is unfairly made, by taking that of the 68-pounder with its ordinary windage of 5 per cent. of the area of the bore. Other experiments, which the *Times* leaves unnoticed, have proved that, by reducing the windage, the initial velocity of a round shot fired from a smooth-bore is increased from 1,500 to 1,800 and 2,000 ft., a velocity which the Armstrong cannot attain. What, then, is the use of showing that, for the special and exceptional purpose of display, a higher initial velocity has been forced out of the rifled 110-pounder, when it is known that the charge which produces it cannot be used in actual service without bursting the gun? CIVILIAN.

MANCHESTER BOILER ASSOCIATION.

AT the last ordinary monthly meeting of the Executive Committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, October 27, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month there have been examined 300 engines and 440 boilers. Of the latter, 32 have been examined specially, 7 internally, 31 thoroughly, and 370 externally, in addition to which 2 of these boilers have been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture 6 (1 dangerous); corrosion 18 (2 dangerous); safety valves out of order, 8; water gauges ditto, 19 (4 dangerous); pressure gauges ditto, 14 (1 dangerous); feed apparatus ditto, 5 (1 dangerous); blow-out apparatus ditto, 43; fusible plugs ditto, 4; furnaces out of shape, 5 (2 dangerous); over-pressure, 3 (3 dangerous); blistered plates, 2. Total, 127 (14 dangerous). Boilers without glass water gauges, 11; without pressure gauges, 2; without blow-out apparatus, 13; without back-pressure valves, 43.

"The three furnaces reported above as out of shape, all became so from overheating, consequent upon shortness of water, the injury in each case being observed for the first time, on setting to work in the morning, after the boiler had been standing during the night with the fires banked up, while two of the cases of injury were first observed on a Monday. Each of the boilers had but a single glass water gauge, two of which were of the pillar construction, while all the boilers were fitted with fusible plugs, which proved inoperative in every instance. One of the boilers was fitted with a fusible plug in each furnace, both the crowns of which came down; the second was fitted with a fusible plug in the right-hand furnace only, and that was the one injured; while the third was fitted with a fusible plug in the left-hand fire-box, and the right-hand was the one injured; but in neither case did the fusible metal melt or give any sign.

"There are several ways in which the water supply may run short in a boiler left standing for the night with the fire banked up, all of which should be guarded against.

"Where there is only a single glass gauge, the attendant may be deceived as to the actual amount of water in the boiler; and thus the supply be left short overnight, unawares. It is well, therefore, to add a duplicate gauge, so that one may act as a check upon the accuracy of the other, this would frequently prevent mistake.

"Again, leakage may occur at the feed back-pressure valve, or at the blow-out tap, either from their being in bad condition or imperfectly closed. Engine-men are not sufficiently alive to the importance of examining these as a precaution, but leave them untouched until proved to be actually defective; whereas the feed back-pressure valve should be frequently taken out, and its free action ascertained; while the blow-out tap also should be examined, the plug cleaned and greased, as well as ground up, if necessary.

"A considerable safeguard also to furnace crowns would be found in a low water safety valve, which lets off the pressure of the steam on a deficiency of water occurring within the boiler. It may be true that it would not necessarily prevent the furnace crowns from becoming overheated, since the fire would go on burning if left to itself, after the water supply had run short; but as the valve would not admit of any accumulation of steam, the injury would be confined to the plates over the fire, unless, by excessive carelessness, the attendant should let in the water and get up steam in the morning without observing the distorted furnace crown. Such, however, could not occur without the most culpable blindness, against which it is impossible to provide.

"EXPLOSIONS.

"Five boilers, not under the inspection of this Association, have exploded during the past month, from which eight persons have been killed and four others injured. Three of the boilers have been personally examined since the explosion.

"The particulars of the first of these explosions may be briefly told. The boiler, which was not under the inspection of this Association, was the outer one of three working side by side and connected together, all of them being of the balloon or haystack class.

"Each of these boilers was of large diameter, the one in question being about 18 ft. at the base, the sides swelling to a still larger diameter at the springing of the hemispherical domed top. The bottom, which was arched, but had no stays to tie it to the crown, was worked into the sides by the plates being bent, and was seated upon a circular kerb of brickwork. Each of the boilers was fitted with a single safety valve, of rather a rough description, while it was stated that the working pressure had not exceeded 5 lbs., but that the exploded boiler, which was twenty years old, had already been repaired several times.

"Immediately over the brickwork seating, the plates for some distance round the boiler had been seriously affected by external corrosion, and reduced in places to one-eighth of an inch in thickness. It was from this cause that the rent occurred, the rent running circumferentially for a distance of 10 or 12 ft. parallel with the seating, and for the most part through the body of the plate. A portion of the bottom was blown down into the ashpit, where it remained, the rest of the shell flying to a distance of about 70 ft. across a public road adjoining, and carrying away a portion of the boiler shed in its flight. The engineer, as well as another man lying near to the boiler at the time, were both scalded, the latter dying shortly after in consequence.

"Competent inspection could not have failed to detect the dilapidated condition of the boiler; while this explosion shows that, however moderate the pressure may be, no boiler can be safely worked unless frequently submitted to a searching examination.

"The second explosion, from which one person was killed, arose from the collapse of the internal flue of a plain Cornish boiler, which was not under the inspection of this Association.

"The diameter of the shell was about 5 ft. 6 in., that of the flue 3 ft., the length of both 28 ft., the thickness of the plates generally three-eighths of an inch, but in the flues barely as much, while the steam pressure was 45 lb. per sq. inch. The collapse had extended from one end of the flue to the other, the portion over the fire being the least affected, while the remainder behind the bridge was completely flattened down. The boiler had not, however, stirred from its seat, or broken a steam-pipe joint, and all that was needed to resume work with the other two boilers, to which this was connected, was to close the junction valve. A rupture in an externally-fired boiler would have led to the dislocation of the whole series. The damage done by the last explosion of a boiler of that class was nearly £1,000.

"The cause of the explosion in question was obvious—viz., weakness of the flue. No flue of such dimensions as those just given can be safely worked with steam of a pressure of 45 lbs. on the square inch, unless strengthened either with hoops or flanged seams, or stayed in some other suitable manner. It may be true, however, that some such flues, though unstayed, are working, and have done so for years with steam of an equal or even a greater pressure than the above; still they are continuing to do so only at a risk, and their past immunity from collapse is no security against its occurrence in the future. Some flues gradually work themselves out of the circular shape, and thus become considerably weakened; while all should be placed beyond the suspicion of danger, especially as this can be done at so trifling an expense. For particulars of the best method of adding hoops to those flues which are already made, see the Association's monthly report of June, 1862.

"The fireman who was killed was standing in the front of the furnace at the time of the explosion, and blown, rake in hand, to a distance of about 60 ft.

"The third explosion occurred to a Cornish boiler with a single flue, internally fired, and not under the inspection of this Association. Fortunately, no one was injured, the explosion occurring during the dinner hour, when the men usually working near it were all absent.

"The boiler was set on two side walls. It was 23 ft. long; its diameter in the shell was 6 ft.; and in the furnace 3 ft. 6 in., which was reduced behind the fire bridge; while the thickness of the plates was seven-sixteenths of an inch.

"The simple cause of the explosion was external corrosion, the plates having been so eaten away as to be reduced to one-sixteenth of an inch in thickness. Two complete belts, the entire circumference of the boiler, and a plate wide, had severed themselves from it; while a third, which had rent in a somewhat spiral direction, and considerably overlapped a single circumference, lay opened out, and still attached to the shell. The two detached belts had fallen, one on each side of the original position of the boiler, doing considerable damage to property thereby; while the main part of it had moved but slightly from its original seating, although it had made a semi-revolution on its longitudinal axis, and lay bottom upwards. The chimney was shattered; the boiler-house, as well as an adjoining building, demolished, and some heavy machinery dismantled."

ELECTRO-MAGNETIC PHONOGRAPH.

THIS machine is capable of being attached to pianofortes, organs, and other keyed musical instruments, by means of which they are rendered melographic, that is, capable of writing down any music that is played upon them.

So keenly have musicians at all times felt the extreme tediousness of writing music by hand, and the impossibility of preserving the most valuable impromptu pieces in their full and flowing beauty, that immediately on the introduction of the pianoforte

into England strenuous efforts were made by men of inventive skill to supply the instrument with the means of registering the music performed upon it. "The first pianoforte seen in England was made by one Father Wood, an English monk at Rome, and by him sold to Samuel Crisp, Esq., who sold it again to Fulke Greville, Esq., for one hundred guineas."* This was about 1757.

The Rev. — Creed would appear to have been one of the first, if not the first, to think of constructing a melographic instrument, and in the year 1774 he sent to the Royal Society a Paper, entitled "A demonstration of the possibility of making a machine that will write extempore voluntaries, or other pieces of music, &c."†

There are also obscure accounts of a machine made in 1770, by a monk named Engramelle.

In a German work of 1774, John Frederick Unger a counsellor of justice at Berlin, claims priority of invention against Mr. Creed, though it seems most probable that each made a similar invention unknown to the other.

There is no doubt whatever that the Académie of Berlin was presented by Hohlfield—an ingenious mechanic who received some suggestions from Euler—with a machine which, to a limited extent, answered its purpose. It consisted of two cylinders moving paper between them, on which, by means of a crayon, each key made a mark when pressed down in the act of playing. But not only was the action of playing very fatiguing, but the music must have been of a most inconvenient width—that of the keyboard—and without any stave, accidentals, &c.; in fact a mere series of dots showing such and such keys were pressed down in the course of the performance, but utterly failing to mark the time, key, or accidentals. The Académie, however, in consideration of the great ingenuity of the contrivance, rewarded the inventor with a handsome gratuity.

In 1827, M. Carreyre made trial, before the Committee of the Fine Arts of the Institute of France, of a melographic piano, which consisted of a clockwork movement, which unwound from one cylinder to another a thin plate of lead, on which were impressed, by the action of the keys of the istrument, certain peculiar signs, which might be translated into the ordinary notation by means of an explanatory table.

"After the experiment, the plate of lead was removed, to make the translation, and a commission was appointed to report; but as no report was ever made, it is probable that the translation was not found to be exact. At the same time M. Baudouin read before the Institute a Paper, accompanying it with drawings, concerning another melographic piano; upon the merit of which we do not find that the Institute pronounced."‡

These accounts prove two important facts; the great efforts made and the small success achieved—this want of success proceeded from the lack of a proper motive power, none having used electro-magnetism—for it must be evident to all acquainted with music that these were as yet nothing more than partially successfully experiments, and produced no further results than stimulating inventors to continual exertions.

The causes of failure were many, the most serious being the oversight of endeavouring to derive the mechanical power from the keys the piano, whereas some power, which, while depending upon the action of the key for its liberation and manifestation, should at the same time exert its force without strain upon the key, still remained a desideratum. Such a power is electro-magnetism, as the mere motion of a piano key, without any alteration in the touch required—may be made to call forth a force of any magnitude required. Now, in Unger's machine the power was derived from the keys alone, and by direct action, thus rendering the touch of the piano so heavy that no one could perform properly upon it. For this reason it is unnecessary to consider further its defects. M. Carreyre's, besides being equally objectionoble on the score of its unavoidably heavy touch and arbitrary and unmeaning signs, produced at the best but an indented sheet of lead, a medium for writing music on most inconvenient and unmanageable.

A machine which should register in plain black and white on common paper the music performed, giving the score on the ordinary stave, using the flat, sharp, and natural signs, as in all modern music, accurately registering time, bars, legato and staccato, 8va, alto, and basso passages, and adapted to all keys, still remained a desideratum, for from 1827 to 1863 no further progress was made, though many continued to give their attention to the subject.

But in 1863 Mr. Fenby applied electro-magnetism, and a machine was patented by him, January 13, in that year, which, without altering the touch or appearance of an ordinary piano, is stated to be capable of registering the most complicated music.

Before giving any detailed description of the construction and capabilities of the phonograph, it may be well to point out the obstacles to be overcome in the notation, and thus to separate the possible from the impossible.

The most obvious difficulty—and one which, if not overcome, would render all other excellencies nearly, if not quite, futile—is the means of marking the various durations of the notes from the breve to the demisemiquaver, &c. This was a difficulty, inasmuch as the ordinary open, closed, and tailed notes cannot possibly be rendered available in an instrument registering that which is performed upon it.

The following considerations will render this apparent. The longest note is practically but the fusion of a number of shorter notes, from which it follows that on any particular key being depressed, as in playing, its first touch would be the shortest note of the notation, and the machine would immediately print such shortest note, and could not afterwards alter it; for to suppose a piece of machinery to render shorter or longer notes by arbitrary signs, having but a fictitious relation to their duration, is to suppose its possession of a reasoning power, the absurdity of which needs no comment. From these considerations, and others which will readily occur to the mind of the reader, it is manifest that some system is required in which the duration of sound and the performance of the printing may be co-existent, and thus produce a complete reciprocity of action between the two. In other words, a short note must be capable of becoming a long one in the printing as in the playing.

Bearing these facts in mind will lead to a complete comprehension and appreciation of the system. Each note shows the portion of time occupied in playing it by the length it occupies in the bar, and consists of a horizontal black line proportionate in length to the duration of the note, while the rest of the notation needs no comment, it being in all respects identical with that at present in use.

Having considered the notation, the next thing to which our attention will naturally turn is the mechanical appliances employed to produce this notation. First, then, as to the touch of the piano; this remains, to all intents and purposes, the same as if without the phonograph attached, as the mechanical power is not derived from the motion of the keys, but from a voltaic battery; the only part performed by the key being to bring a small brass stud, on its under side, in contact with a slender spring; this causes an electro-magnet to bring a tracer against the paper which is continually moving at a fixed rate and thus marks the note. When the key is no longer depressed, the tracing ceases, and the rod slides back; this mechanism being capable of registering the slowest or most rapid playing. The accidentals are printed by revolving type, acted on by the same sliding-rod and magnet. The accidentals are adapted for all keys, so that any number of flats or sharps may be correctly registered; the machine being capable of distinguishing accidentals, flats, sharps, and naturals from those which are proper to the key in which the music may be pitched—that is to say, if the key A natural be used, F, C, and G, when played sharp, will have no sharp sign in the body of the music, whereas if the naturals of these notes be struck, or the sharps of any others, suitable accidentals will be printed.

Having now reviewed the notes and signs proper to them, the bars will be considered. The barring of the music is performed in a simple manner, precluding the possibility of derangement, and is yet so accurate in adjustment that it correctly follows the accentuation of the most complicated piece of music. When a rallantando movement occurs, the bar or bars through which it runs will be actually lengthened in such a proportion as will accurately denote the character and expression of that part of the music. The same manifest advantages occur in the matter of legato and staccato movements.

The machine requires only blank paper, as it rules the stave and prints the score simultaneously. The inventor furnishes a small battery of convenient and simple form. The charge consists of sulphate of copper and water: one charge lasting for some months. The whole is in a neat drawer at the bottom of the machine, and offers nothing of difficulty or unpleasantness in its management, and requiring to be touched only to supply water to it.

* Rimbault's History of the "Pianoforte."
† Phil. Trans., vol. xliv., p. 445.
‡ Rimbault.

THE "FAR EAST."

THE launch of this vessel took place from Messrs. Dudgeon's building yard, at Cubitt-town, Millwall, on Saturday, in the presence of a large number of people, including Mr. J. E. Reed, Chief Constructor of the Navy; Mr. James Luke, Inspecting Officer of the Controller's Department of the Admiralty; Mr John Dinnen, Inspecting Engineer to the Admiralty; Vice-Admiral Sir Edward Belcher; Captain Thomas; E. Symonds, R.N., patentee of a system of double-keeled and screw vessels; and others whose names are well known in connection with marine engineering. The launch of any first-class ship that may be destined to take a part in the vast commercial enterprise between England and the most distant parts of the earth, must always be attended with a considerable degree of interest. In the present case, this interest was much enhanced by the fact of the "Far East" being the first vessel of her class to which the double or twin-screw system has been applied. Her principal dimensions are as follows:—Length between perpendiculars, 227 ft.; length of keel, 210 ft.; breadth of beam, 34 ft.; depth moulded, 22 ft.; depth of hold, 20 ft. 6 in.; depth at load water line, 17 ft.; displacement of hull, 2,200 tons; builders' measurement of tonnage, 1,270 tons. On her upper deck she has a capacious poop and forecastle, and the usual house and cabins amidships. She is fitted with engines of 150-horse power nominal, which drive a two-bladed lifting screw under each quarter. The engines have combined cylinders, the diameter of the high pressure cylinder being 24 in., and of the expansive cylinder 50 in., with a stroke of piston of 2 ft. The screws have each a diameter of 8 ft. 2 in., and a pitch of 16 ft. The two boilers have each six furnaces, with 109 square feet of firebar surface, and a tube surface of 1,883 ft. The shafting of the screws projects through a wrought-iron tube of great strength, which is bolted on to a false iron bulkhead, clear altogether of the ship's frame. This tube at its outer end is connected with a massive wrought-iron slide, which guides the screw to the well when being lifted, or to the shafting when being lowered. The ordinary "cross-coupling" by which the screw is connected with the shafting is superseded in the "Far East's" shaft by a square head at the end, which fits into a corresponding recess in the boss of the screw, which is connected by a thrust block fixed on a sliding rest. The screws are lifted by a worm and barrel; the whole arrangement for lifting the screws into their wells on each quarter looks perfectly efficient, and, at the same time, of that simplicity which is of itself the best recommendation of all similar mechanical arrangements. The launch was perfectly successful.

ARTIFICIAL MARBLE.

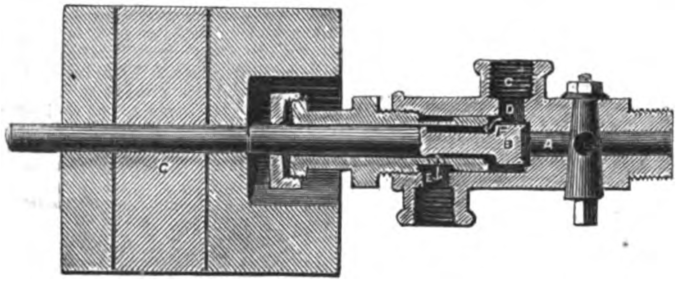
SIR JAMES HALL upon one occasion produced crystalline marble by subjecting chalk to a high heat in a close vessel. Professor Rose, of Berlin, Prussia, tried the experiment, and failing to produce such a result denied the correctness of Sir James Hall's statements. Being assured that crystalline marble had thus been produced, and that the specimens could be seen in London, he entered upon a second experiment, and in a recent communication to the Berlin Academy of Sciences, Professor Rose states that marble can be produced by exposing massive carbonate of lime to a high temperature under great pressure. His experiments were made with aragonite from Blin in Bohemia, and with lithographic limestone. In one case the mineral was heated in a wrought iron cylinder, and in the other in a porcelain bottle, the vessels being air-tight. They were exposed to a white heat for half an hour, and on cooling, both the aragonite and the lithographic limestone were found converted into crystalline limestone; the former resembling Carrara marble, and the latter a grey granular limestone. The change was effected without material decomposition; the resulting marble containing a trifle less carbonic acid than the lithographic limestone, from which it was produced.

It is announced in the Paris papers that the brothers Godard are about to make a balloon to contain 14,000 cubic metres of gas, whereas M. Nadar's "Giant" only contained 6,000.

CUTHELL'S IMPROVEMENTS IN SELF-ACTING DAMPERS FOR STEAM-ENGINE FURNACES.

In carrying this invention, by Mr. Alexander Cuthell, of Sketon, Lancashire, into effect, an equilibrium valve is placed in any convenient position between the boiler and cylinder, in connection with the steam-pipe, and capable of being adjusted to any required pressure by means of springs or weights. A piston working in a cylinder or some other analogous contrivance is employed, the valve being placed so as effectually to close the communication between the boiler and the cylinder and piston until the pressure of the steam in the boiler is above that at which the valve has been adjusted. The damper is connected with the piston by means of suitable rods or gearing, such as will be well understood by persons conversant with the construction of steam machinery. Upon the pressure of the steam in the boiler overcoming the resistance of the valve, the latter is actuated; and the steam being allowed to enter the before-mentioned cylinder, the piston consequently rises and the damper is lowered by the upward motion of the piston. The valve being upon the equilibrium principle is not affected by the pressure of the steam in the contrary direction after passing it, and the valve will consequently act freely under any variation of pressure in the boiler. The escape of steam from the cylinder may be effected by the action of the valve in shutting-off the communication between the boiler and the cylinder, by a small aperture at the bottom of the cylinder so constructed as to let off the steam gradually, and which aperture may be kept constantly open.

A, in the accompanying drawing, represents



the opening from the boiler; B is the moving part of the valve and the spindle combined; C, C, are the weights, through which the spindle passes; D is the opening to the cylinder; E is the waste steam pipe; G is the feed pipe to the cylinder. When the steam is of sufficient pressure to lift the valve B it acts on the piston, which moves the damper, the communication to the waste pipe being shut at F. When the pressure of the steam is reduced, the valve returns to the under seat, the steam from the cylinder being allowed to escape to the waste pipe, while the piston is allowed to return to its former position. It will be observed that the valve is represented as being adjusted by means of weights; but instead thereof, springs may be employed.

SOCIETY OF ENGINEERS.

Continued from page 723.

In April, 1861, Messrs. Shand and Mason supplied to the London Fire Brigade an engine (now stationed at Tooley-street) very similar in its general form to Braithwaite's, except that it has a slotted cross-head crank and fly-wheel, instead of the tappet motion, for working the slide valve, and is, to all intents, an ordinary donkey engine. The same boiler is used in this engine that was in the one last mentioned, and has been used at the Tooley-street Station up to the present time. I may, however, mention, that it will shortly take its departure from that station, and will be succeeded by my little "Princess of Wales."

In April, 1862, Messrs. Shand and Mason constructed another engine very similar to the last named, and called "No. 10." This engine is still working at the Wellclose-square Station.

In 1861, Messrs. Merryweather constructed an engine, the "Deluge;" but, as a description of this engine has already appeared in the Mechanics' Magazine, it is unnecessary to repeat it here.

About the same time, Mr. Roberts states that he constructed the *first self-propelling* steam fire engine in this country. A description of this engine has also appeared in the Mechanics' Magazine.

Mr. Roberts then alluded to the American steam fire engine which appeared in the American Department of the International Exhibition.

In April, 1862, Messrs. Shand and Mason supplied the engine "No. 10.," formerly described, to the London Fire Brigade, and this brings us up to the first competitive exhibition. Hitherto, Messrs. Shand and Mason had the whole run; but, by some means, Messrs. Merryweather had got permission to put their engine, the "Deluge," into the Exhibition; and Mr. Roberts considered that the manner in which the authorities of the Exhibition behaved in the matter of fire engines was most disgraceful. Messrs. Shand and Mason and Messrs. Merryweather and Co.'s exhibitions commenced at the main entrance, and were continued all over the building, and the engines of all other makers were stowed away in a sort of lumber room at one corner of the building, under one of the towers.

After the trials of hand engines, and when the "Deluge" was ready, the sub-committee decided to have the steamers tried; but, for reasons best known to themselves, Messrs. Lee and Larned declined to have their engine tested or tried. Mr. Roberts was in difficulties with the Benson boiler in his engine, and had not the London Fire Engine Establishment lent the engine "No. 10," and the one made by Shand and Mason, supplied to the London Fire Engine Establishment in June, 1862, Messrs. Merryweather and Sons would have walked over the course. As it was, a field day was got up: Messrs. Merryweather were the first to get up steam; but, unfortunately, the nut of their piston rod worked loose, and, for a time, disabled their engine; and, later in the day, they burst a pipe, which compelled them to withdraw from further trial. There can be no doubt that Messrs. Shand and Mason's engine "No. 10" worked the most comfortably, if I may use the expression, upon this trial. They were a considerable time longer getting steam; but, when it did start, it went off smoothly. Upon the other hand, Messrs. Merryweather's engine bumped in a very unpleasant manner, sometimes banging back and forward with sufficient force to break it up.

Shand's small engine worked very well; the most noticeable thing being the priming of the boiler. The boiler is a double-cone, the water space being between the two and the fire inside; the steam cylinders are single-acting, and placed over the pumps precisely as in the first float; the crank shaft is between them, but, instead of working in a slot, is connected to the pump piston, in the same manner as in the pump of 1858; the pumps are also single-acting, exactly as the first float; and like the hand engines, the engine had worked at 32 fires in six months, the average time at each being two to three hours.

As all the steam fire engines since made in London were tried at the Crystal Palace in July, we will now proceed to review these trials.

The jury, or, perhaps, more properly, the sub-committee of Class 8 in the late Exhibition, feeling that the three engines exhibited, or rather tried in Hyde-park, did not fairly represent the skill of this country, a movement was set on foot to get a fund, and offer such prizes as would induce other makers to come forward with engines.

A committee was formed and a sum of money obtained, and the following prizes offered—viz., £250 for the best, and £100 for the second best engine in each class, the classes being two—those between 30 and 60 cwt., and those under 30 cwt.

The chief points to which the committee directed their, or rather were to direct their, attention, in addition to the consideration of cost and weight, were those relating to the general efficiency of the machines as fire engines; combining among other points of excellence, rapidity of raising and generating steam; facility of drawing water; volume thrown; distance to which it can be projected with the least amount of loss; simplicity, accessibility, and durability of parts.

Upon the faith of this, seven makers entered their names for ten engines as follow:—

Merryweather and Sons, two; Shand, Mason, and Co., two; Butt and Co. (American), two; Easton and Amos, one (American design); Nicols (American), one, "Manhattan;" Gray and Son, one; and W. Roberts, one.

First, the "Torrent," by Merryweather and Son. This engine has been so often and so fully described in the pages of the Mechanics' Magazine, that it will be only necessary to say at present that it had been cut down or reduced in weight to bring it within the 30 cwt.; even the coal bunkers and foot-plate were taken off, rendering it for all practical purposes useless as a steam fire engine; yet still it was 1 qr. 12 lbs. over weight, but was allowed to work in the small class.

The next engine that Mr. Roberts described was the one made by Messrs. Easton and Amos, from designs by Messrs. Lee, and was, therefore, to all intents and purposes, an American engine. It was called the "Sabrina," but was formerly known as the "Annihilator," under which name it appeared at Lambeth. At this time its weight was 3 tons 2¼ cwt., but for the trial at the Crystal Palace was cut down to 2 tons 18 cwt. 3 qr. 12 lbs. This engine has been pretty fully described.

The engines that made their first appearance on the 1st of July were:—First, the "Sutherland," Merryweather, Son, and Field. The weight of the engine was 2 tons 18 cwt.; it has two steam cylinders 8½ in. diameter, with 24 in. stroke, the two pumps being 6½ in. diameter, also 24 in. stroke. The boiler is similar to the "Torrent's," and is described as being vertical, tubulous, circulating, shell of homogeneous metal, 5-16ths in. thick full, double rivetted; tube and top plate of Lowmoor iron, 11-16th in. thick; stays of bowling iron, 1 in. diameter; tubes of solid drawn copper, height 60 in., and will contain from 30 to 10 gallons of water (a rather wide margin) when at work. The pumps are the same description as those in the "Deluge" and the "Torrent;" the valve arrangement, which must have received an immense amount of consideration, is described in the Mechanics' Magazine of July the 10th.

At the trials on the 1st of July, this engine was second to get steam to 100 lbs. per inch, and show water, but was first into the hood, and, barring being occasionally short of steam, worked very well during the day, but nearly came to grief by cracking the end of the pumps. However, this was repaired in the course of the night, the engine being taken off the ground, a thing that I consider the committee ought not to have allowed on any consideration. The engines should have remained upon the ground, and, if incapable of going through the whole of the trials should have been disqualified. Mr. Roberts wished it to be clearly understood that he would not object to anything that could be done readily upon the grounds; but certainly the engines ought never to have left the grounds until the trials had ended.

On the second day, at the 18 ft. lift, this engine being primed, or rather the pumps and suction pipes, fetched the water immediately, from the simple reason they had no distance to fetch it, and filled the tank in 1 hr. 24 min. 55 sec., and against the water tower threw a 1⅛ jet 108 ft. high, for a few seconds, and was awarded the first prize of £250.

The next engine was by Shand, Mason, and Co., already described in the Mechanics' Magazine. The weight of this engine was 2 tons 17 cwt. 12 lb., and had two steam cylinders of 8¼ in. with 9 in. stroke, and water cylinders of 7 in. diameter, also 9 in. stroke, and appears to be just two of the engines used in "No. 10" (formerly described) placed side by side.

This engine was third to get steam to 100 lbs., the time being 11 min. 45 sec., instead of 10 min. 51 sec., as stated in the report; the water in this boiler was very unsteady, as might be expected from the closeness of the tubes, about ¼ in. apart.

Upon the second day's trial, there was considerable difficulty to fetch the water at the 18 ft. lift, the pumps had to be primed repeatedly, they not having a foot valve in the suction pipe, the water ran away before the rose could be got into the water, but when they did get to work they went on very steadily. At the trial against the tower for height, this engine threw a very steady stream, the jet being 1⅛ in., but from some cause did not long continue working. Mr. Roberts felt bound to say, that he believed the cause was that the committee had said that was sufficient, and Mr. Shand being anxious to get back to his small engine had drawn his fire.

The next engine mentioned in the awards was the one Mr. Roberts had the honour to exhibit, but which he did not intend to work in this class.

The boiler of this engine is 30 in. diameter and 20 in. high, and contains 248 $\frac{3}{4}$-in. tubes, screwed at each end so that each tube is a stay. The fire-box is 24 in. deep and is composed of 1-in. tubes, the lower ends being screwed into a water ring, and every alternate tube goes straight up into the lower tube plate; every other tube bends off when about 3 in. from the tube plate, and is carri d towards the centre of the tube plate, when they are screwed into places left for them. The feed water passes first into the ring at bottom, and then rising through the tubes passes into the boiler in thirty-two places; consequently, a certain supply is kept up among the tubes, the steam is taken off in the same way, and priming entirely prevented.

The steam cylinder is 7 in. diameter and 13 in. stroke, and has a common slide valve worked by an eccentric. The pump is one of Mr. Roberts' patent pumps; it is a plain cylinder $9\frac{1}{2}$ in. diameter, there is an axis working through the centre in stuffing boxes: upon this axis is a cross-head, in the top and bottom of the cylinder are buckets exactly alike; these are connected to the cross-head by forked rods and links, also duplicates of each other; upon one end of the axis there is a lever, and on the other a kind of bell crank. Two rods connect the ends of these levers to the cross-head of the engine; right under the slide jacket is a shaft running in suitable bearings and having the eccentric between them; upon one end of the shaft is a small fly-wheel, having a pin in one of the arms to serve as a crank; this is connected by a rod with the short arm of the bell crank lever. It will readily be seen by this that, as the piston works up and down, the buckets in the pumps advance to and recede from ea h other, causing a constant flow of water, not checked to that extent that it must be in all pumps where it has to be stopped and turned into another channel; it will also be seen that a rotary motion would be given to the eccentric shaft.

The stroke of the buckets of this pump is $3\frac{1}{4}$ in. each; it will, therefore, be seen that the water pistons or buckets travel at one-fourth the speed of the piston, also that all parts of the machine are readily got at.

This engine was *first to get steam to* 100 *lbs. and throw water;* but, from its position being placed to windward of all the others and its small size, it was of course beaten in quantity but not in steady working.

At the 18 ft. l ft it fetched the water immediately *without priming*, although a piece of canvas near half a yard square was afterwards found in the pump, and in the first hour's working it threw *exactly the same quantit of water into the water temple that Shand and Co.'s large engine did, viz.*, 20 *in.* Shortly after this, the head of a rivet came off, and the engine had to be worked easy, for fear of breaking down altogether.

Throughout the whole of the trials this engine worked steadily; there was scarcely any oscillation, no priming, very little variation in either steam or water pressure, and taking *power* into consid ration contrasts very favourably with the prize engines; thus, in the first trial, the "Sutherland," with steam cylinders more than *five and a-half times Mr. Roberts' capacity, and water cylinders six and three-quarter times the capacity of his pump, it took* 9 *min.* 42. *sec. to do the work that it took* 20 *min.* 24 *sec. to do with his;* the steam pressure at starting being the same, viz., 100 lbs. per inch, or, in other words, they did *two and one-quarter times* the work with *five and a-half times the power.* Again, if we take Shand, Mason, and Co.'s engine, we find its steam cylinders are more than *twice* the capacity of his, and the water cylinders *three and a-quarter times*, and yet it takes them 12 min. 19 sec. to fill their tank, *or one-fourth longer* than they should do it in, according to the time taken by Mr. Roberts' engine, and this, too, when from their position they had the benefit of all the spray from the other engines.

Again, if we take the third trial, which was, in fact, the principal trial, we find that Merryweather's engine delivered 16,086 gallons in 1 hr. 24 min. 55 sec., or say 189 gallons per minute, with an average steam pressure of 91 lbs., and water pressure of 89 lbs., and Mr. Roberts' engine delivered in the first hour before the rivet gave way, 5,560 gallons, or 92 per minute, just *half its more bulky competitor*, and this with an average pressure of 75 lbs. both steam and water, and if we take the whole two hours it brings us exactly the same as the first trial, viz. *two and a-quarter times the work for five and a-half times the power;* and as Shand's engine only delivered the same quantity in the first hour and not one-third more in the two hours, Mr. Robert's thought he had said enough to prove that the *best engine did not obtain either the first or the second prize*, and if they had taken trial at the water tower the case would not be altered.

Having previously described the "Annihilator," *alias* the "Sabrina," it is only necessary to say that it was fourth to get steam and di l very good work at the low lift, but could not accomplish the 18 ft. lift, and was finally withdrawn, the most noticeable point being that during the time it did work the average water pressure was only 41 lbs. to 98 lbs. steam.

We now come to the engine called the "Victoria," built by the Amoskeag Company, of America, and imported by Messrs. Lee, but entered under the name of Butt and Co. (We must refer our readers to the MECHANICS' MAGAZINE for a description of this engine.)

There was one other engine of which great expectations were formed—the "Manhattan," No. 8. This was sent over by the New York Fire Company, and was the crack engine there. This engine, in going to the place of trial, capsizes, seriously injuring one man. It was tried upon the second day, and considered fit for work by those in charge. It certainly threw a very good jet; but upon trying it the next day at the high lift and long range, it soon became evident that it was unable to do it, and finally came to grief by bursting the boss of the remaining fly-wheel. This engine was repaired, and afterwards tried at the Shadwell entrance to the London Docks, but totally failed to maintain its reputation.

There was one other engine entered for this class, one made by Gray and Sons, of Limehouse. This had a rotating boiler, but was not got to work.

We now come to the small class engines. Strictly speaking, there were none under 30 cwt. The "Torrent" had its coal bunkers and foot-plate taken off, besides other alterations. Shand, Mason, and Co.'s engine had no hose reel, although fitted for one; and Messrs. Lee's had some small parings to bring it to weight.

The steam cylinder of Messrs. Shand, Mason, and Co.'s engine was $7\frac{1}{2}$ in., with 8 in. stroke; the pump was of the combined bucket and plunger, the plunger being hollow. The crank shaft was placed fore and aft, and the fly-wheel athwartships, the connecting working in the hollow plunger. In the report the diameter of water cylinder is given as 9 in., but the diameter of plunger is not stated. The bucket has six and the foot-plate seven india-rubber disc valves, $2\frac{3}{4}$ in. diameter. The boiler was described in the MECHANICS' MAGAZINE, July 10.

This engine got up steam to 100 lbs. in 11 min. 36 sec., and filled the tank in 5 min. 24 sec.; on the third trial, steam was got up about 10 o'clock, but the engine could not be got to work—first, some shavings got into the pump and stopped, or rather prevented its working (he wished the canvas had served him the same), then something else went wrong, and, finally, it was got ready to start at 7 p.m., yet in the report the remark is "worked well throughout;" the report also states that the average pressure of steam was 146 lbs., and the water 80 lbs.; but when Mr. Roberts saw it at work the water did not exceed 60 lbs. He thought there must have been something very wrong here, 146 lbs. of steam, and 60 lb. only of water. His engine, with the same size jet, the same length of hose, the same lift, in all things similar, with 75 lbs. of steam, gave 75 lbs. of water. Lee and Co.'s "Victoria," with 78 lbs. steam gave 78 lbs. water; the "Sutherland," with 91 lbs. of steam, gave 89 lbs. water, again nearly equal; Shand's large engine, 96 lbs. steam, 62 lbs. water (one-third less); Easton and Amos, 98 lbs. steam to 41 lbs. water (this was worst of all); the "Torrent," 86 lbs. steam, and 45 lbs. water; and the "Alexandra," 80 lbs. steam, 60 lbs. water.

During the trial, the fire was from 1 ft. to 2 ft. above the top of the chimney, a state of things no boiler, with tubes made of 19-gauge iron, and spanned a fourth of an inch apart, can long stand. The oscillation of this engine was also fearful.

The "Alexandra," also made by the Amoskeag Company, and imported by Messrs. Lee, was in every way similar to the "Victoria," but smaller, having a $7\frac{3}{4}$ in. steam, and $7\frac{1}{4}$ in. water cylinder, with a $9\frac{1}{2}$ in. stroke; this engine got steam in 11 min. 55 sec., and filled the tank in 6 min. 3 sec., and at the long lift and range fetched the water directly, and worked on its allotted hour without stop, and obtained the second prize of £100.

The "Torrent" having been fully described, it is only necessary to say that it got steam to 100 lbs. per inch in 12 min. 15 sec., and filled the tank in 9 min. 15 sec.; at the third trial, very great difficulty was found to fetch the water—in fact, it was not until it had been repeatedly primed that it succeeded, but after it did get to work it went on very steadily.

Mr. Roberts then went on to say that, with regard to the committee, he felt bound to say he believed every member was actuated by the best motives, and thought they deserved the best thanks of society for the trouble they took in this matter, but they were unfortunately in the position of the man who tried to please everybody, and so pleased nobody; had they stuck to their rules, and carried them out to the letter, they would have been just as well thought of.

NEW MODE OF DRAWING METAL TUBES.

A POWERFUL hydraulic machine, embracing many constructive novelties, has recently undergone some severe tests at Johnstone, near Glasgow. The machine is for drawing tubes of cast steel and other metals from the cold bar, without join or weld, in the following manner:—A ronnd bar of cast steel has a hole pierced up the centre, and one end tapped to the depth of about $1\frac{3}{4}$ in. The piece of steel thus prepared has the tapped end—which is bevelled back about an $1\frac{1}{4}$ in., to admit of its being passed through a wordle or draw-plate, having a hole 1-16th in. smaller than the piece of steel to be drawn—secured to the end of the draw-rod, which is secured to the flange of the pist n; therefore, when the water is pumped into the cylinder, the piston is forced out, and in making its travel, draws the steel through the wordle; but were the drawing to take place from the surface alone, a considerable tensional strain would be thrown on the inner particles, but this is obviated by drawing over a mandril, having a bulb at the end, which not only eases the strain, but polishes the bore as well.

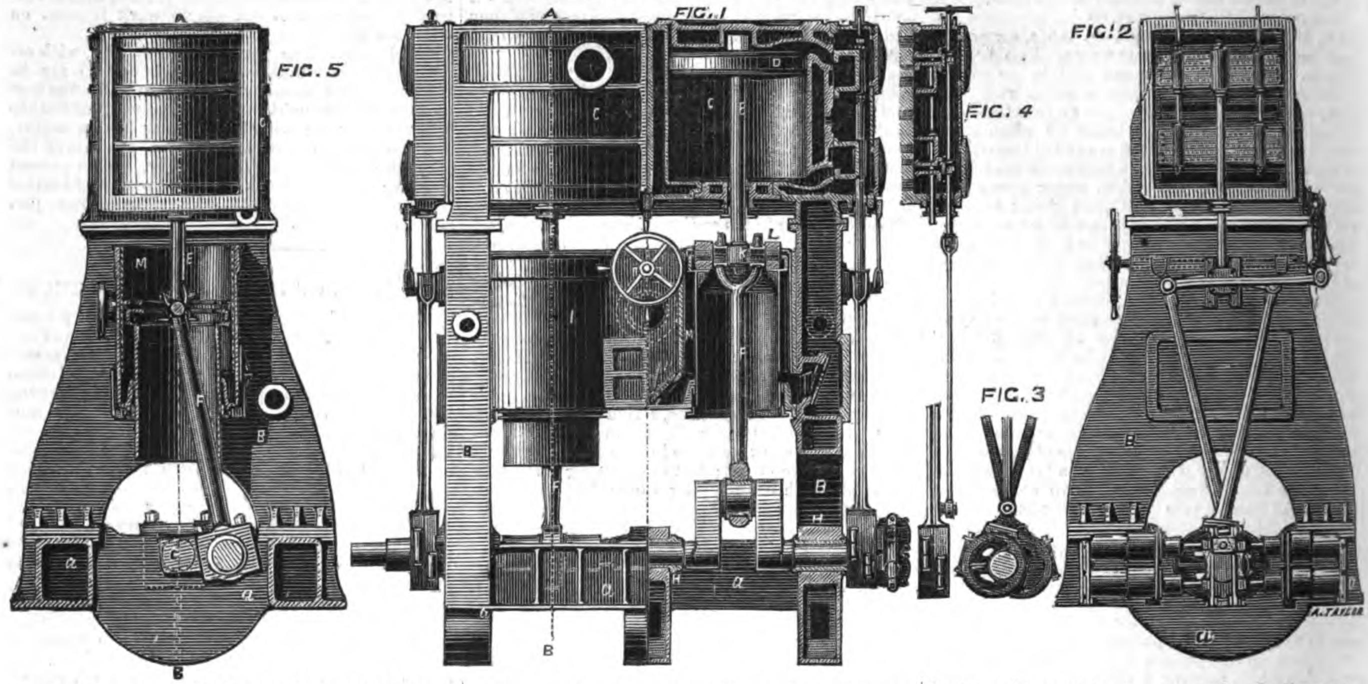
The recent trials consisted in passing several pieces of cast steel, about 2 in. diameter, through the wordles, reducing them 1-16th in. at each pass, and giving an elongation of about $1\frac{1}{4}$ in. to each pass. Now, when it is considered that cast steel is one of the most delicate metals to manipulate, even hot, some idea can be formed of the difficulty of working it in its cold state; but so great a command have the patentees obtained over this obdurate metal that they appear to work it almost as easily as lead. The quality of the steel is special, and the only make that has been found possessing the necessary ductility for being drawn cold is produced by Hawksworth and Co., who, for a number of years, have given special attention to the production of mild steels.

The machine—a ponderous affair of some 30 tons—consists of a double cylinder and double pistons, the cylinders having flanges at each end about 5 ft. square by 9 in. thick, and having recesses at given distances, into which draw-plates, or wordles, and mandrils are fitted. The cylinders are placed at a distance of 10 ft. apart, and a pist n, $16\frac{1}{4}$ in. diameter, gives motion to a cross-head or plate of the same size as the cylinder flange. Into these flanges steel draw-bars are secured. When the piston on the right hand side is home, the two flanges are together—in other words, the cross-head plate and the cylinder cover are in close approximation. The steel to be drawn is screwed into the draw-bar, when the piston, on being forced out with the water, pulls the steel through the draw-plate; and this is continued until the tube is brought to the proper size, the steel being annealed several times during the process.

For large tubes the steel is cast hollow, thus saving the cost of boring and the waste of metal. The patentees are sanguine of being able to make tubes large enough for the bore of the Armstrong gun. A large demand is also anticipated for them for boiler tubes, surface condensing tubes, piston-rods, hollow shafting, axles, gun and rifle barrels, &c. Some beautiful specimens were exhibited, drawn in Paris—where the patentees have been carrying on their experiments for some time—consisting of square tubes with square holes, square and octagon tubes with round holes, and round tubes various sizes; but the one that engaged the most attention was a portion of a 50 ft. one about 3-16ths in. diameter.

The *Glasgow Herald* states that the machine has been constructed, under the superintendence of one of the patentees, for a company in London, and leaves for there in a few days. Its power is equal to 600 tons pressure, and is the first of the kind constructed in Scotland, and for accuracy of workmanship and beauty of execution, reflects great credit on the maker, Mr. M'Arthur.

JACKSON AND WATKINS' STEAM ENGINES.



JACKSON AND WATKINS' IMPROVEMENTS IN STEAM ENGINES.

THIS invention, patented by Messrs. W. Jackson and R. Watkins, of Millwall, Engineers, relates chiefly to those forms of engines known as direct-acting engines, and whether such engines be vertical, horizontal, or inclined, and whether employed for marine or stationary purposes.

Instead of employing a guide block and guides, or any of the usual methods of guiding and supporting the outer end of the piston rod at its junction with the connecting rod, and instead also of working a pump by a lever or from off the crank by an eccentric or other means of communicating motion, the patentees effect these two objects of guiding the piston rod and working the pump by placing the pump barrel with its longitudinal axis in or nearly in a line with the cylinder, and between the cylinder and the crank shaft; and connecting the pump plunger or piston to the piston rod, and the end of the connecting rod of the engine by a fork end or any other suitable means; thus the pump is worked direct, and forms also the guide for the piston rod.

In condensing engines the air pump is the pump employed in this manner. The piston or plunger of the pump is of sufficient diameter to allow of a trunk large enough to permit of the connecting rod vibrating within it; and where the distance between the cylinder end and the crank shaft is limited, as is generally the case in marine engines, the patentees prefer to employ a single-acting and single trunk pump, the capacity of the pump chamber or barrel being regulated by the dimensions of the annular space, or the difference between the exterior diameter of the trunk and the interior diameter of the pump barrel.

In inverted direct-acting screw engines the valves may be placed at the bottom of each pump in direct communication with the condenser. In every case the connecting rod works within the trunk of a pump placed between the cylinder and the crank, and the cylinder of the pump and the packed end or ends thereof, or the piston and the gland alone are the means of guiding the piston rod, and of taking the thrust due to the angular motion of the connecting rod. For working the back slide or cut-off slide of double-slide valve engines, it is connected to the backward eccentric or its rod directly through a weigh shaft or by any other of the well-known means, and the amount of expansion regulated changing the positions of the slides by means of a screwed valve rod or other suitable means.

Fig. 1 is a general elevation or side view, one half in section, of a pair of inverted cylinder direct-acting screw engines, constructed in accordance with this invention; fig. 2 is a forward end elevation of fig. 1, the cover of the slide chest being removed the better to show the slide valve and face; fig. 3 is a transverse sectional view taken on the line A, B, fig. 1.

In each of the figures 1, 2, and 3, *a* is the sole plate, upon which the two hollow legs B, B, are bolted, and C, C, the steam cylinders bolted back to back and supported upon the hollow side frames or legs B, B, which form the condensing chambers; D, D, the pistons; E, E, the piston rods; and F, F, the connecting rods. The double crank shaft G is supported in the three bearings H, H, H, of the sole plate A. Between the side frames or hollow legs B, B, is fitted a casing I, for containing the two single trunk air pumps, the barrels of which also act as guides. At the upper end of each air pump trunk the fork end of the connecting rod is connected to a short cross head K, fitted upon the piston-rod end, and also secured in carriages L to the trunk and piston of the air pump M, and so admitting of the connecting rod vibrating within the air-pump trunk.

In figs. 1, 2, and 3 the forward and backward eccentrics, the link, and the gear for reversing are of the ordinary description, and the feeding and bilge pumps are placed horizontally at the fore end of the engine, as shown in figs. 1 and 2, and all four pumps are connected to a slot link, and are worked by means of a stud projecting from the face of one of the outer eccentrics of the forward engine, or the pumps might, if preferred, be worked by a pin fitted direct into the end of the crank shaft, or into a disc keyed to the crank shaft outside the eccentrics.

Fig. 4 is a sectional view of the valve face of the cylinders, the valve chest, and the main and expansion slide valves, with their rods and means of regulating the "cut-off" at the back of the main slide by separating or bringing together the two expansion slides or cover plates, by which the steam is admitted through the main slide to the steam ports. The rod of the main slide valve and the expansion valve rod pass through a gland in the slide chest, and are moved together by the eccentric gear; but the expansion valve rod is not connected to the link block, but by means of a rod or bar to a stud or pin projecting from the face of the backward eccentric strap or rod. On the upper end of the valve chest the rod of the expansion slide passes through a gland, and has a hand wheel or cross fitted thereon, for the purpose of turning it, and thereby changing the position of the expansion slides or cover plates in relation to the steam passages or openings through the main slide valve; the expansion valve rod is screwed with a right and left hand thread, and the lower end of the rod is made to turn or swivel when it is required that the degree of cut-off shall be changed.

The several parts of the apparatus for working the valve gear, and the several parts consisting of the valve face, valve chest, and covers, the slide valves and their rods, are so distinctly shown in the two figs. 2 and 4 as to render the employment of letters of reference unnecessary.

In adapting our invention to horizontal or other forms of direct-acting pumping engines for raising or forcing, or raising and forcing water, we apply a trunk pump of suitable dimensions placed between the cylinder and the crank as herein previously described, and for this purpose we may employ a double-acting pump with double trunk by increasing the length of the piston rod and the connecting rod.

PAGNY'S AGRICULTURAL IMPLEMENT FOR CULTIVATING ROOTS.

THE agricultural implement forming the subject of this invention, patented by M. Aimé Pagny, of Paris, is a ridge or bouting and at the same time a roller plough. It is composed of a ploughshare with double mould board (smaller than for ordinary bouting ploughs), and of four conical rollers acting on the inclined plane of the ridges. The share, the main object of which is not the bouting or ridging, breaks the sub-soil, cleans the water furrows, and thus prepares the work of the rollers, which follow it. The two first, which are placed on each side the mould boards, simply dress the earth; the two latter, on the contrary, which are more open, more inclined, and placed higher, press or settle down the earth and form the ridge. Four iron rods, hinged at S, S[1], (figs. 1 and 2 of the drawing), serve for axles, and receive four reversed conical rollers, that is to say, with their heads downwards. These rods slide freely at their upper part in two cross pieces, which may be compared to the branches of a compass. The head of this compass is about 12 in. apart behind the share, and the two branches, about 28 in. long, play at their

ends on a cross piece. A screw permits the opening to be adjusted at from 16 in. to 24 in., according to the greater or lesser pressure required. The inclination of the rollers is only equal two by two, because the fixing point at the base is the same, and the spreading apart of the points of the compass is more or less developed. Lastly, a wheel, about 8 in. in diameter, placed at the back of the plough, relieves the arms of the labourer, and it is this wheel G which keeps the two last rollers at an elevation of, say, 4 in., in order that they may more easily form the ridge.

PAGNY'S AGRICULTURAL IMPLEMENTS.

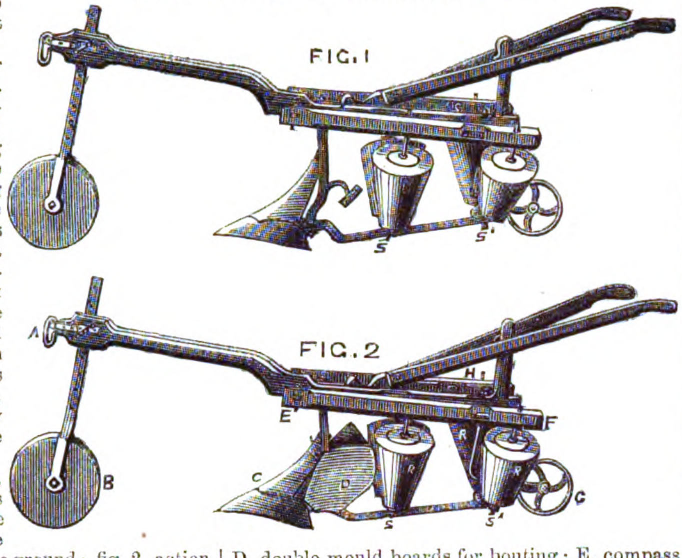
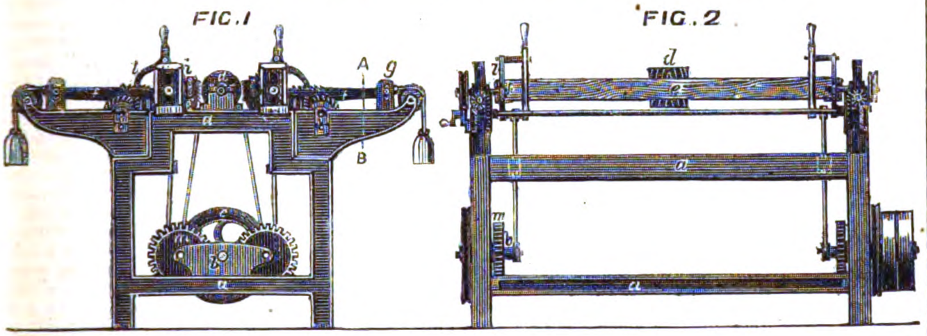


Fig. 1 in the drawing, action of the rollers when the ridges are formed, the tubercles, the seed, the colza being in the ground; fig. 2, action of the rollers, the virgin soil being turned up and the bouting or ridging being done.

A, hook for harnessing; B, wheel which regulates the depth of the ploughing; C, ploughshare; D, double mould boards for bouting; E, compass head; F, branch of compass; H, pin which regulates the setting apart; G, hind wheel; R, rollers; S, S¹, point where rollers are hinged.

ALLEN AND JOHNSON'S IMPROVEMENTS IN GRINDING CARDS.



ALLEN AND JOHNSON'S IMPROVEMENTS IN GRINDING CARDS.

THIS invention, patented by Messrs. Allen and Johnson, of Cheadle, and Newton Moor, Cheshire, cotton spinners, relates to the small carding surfaces employed in carding engines generally attached to a continuous chain, and termed "flats," and is designed for the purpose of grinding the surface of such cards in an even and true concave form or in any other form desired.

The improvements consist in the novel employment and use of a guide or peculiar-shaped groove to cause the "flat" to approach and recede from the grinding cylinder at certain intervals so that such guide governs the superficial form into which the surface of the flat is ground. The form of the groove or guide will depend upon the particular form to which the "flat" is to be ground, whether truly vertical, simply curved, or S-shape, or diagonal. The flat is secured at the end of the radius rod or lever, the opposite end of such rod being furnished with a spring or weight, and at any point in the length of the rod a bowl or roller is attached, working or sliding in or against the aforesaid guide or groove, the weight or spring retaining the bowl in contact with the guide, and between the guide and the "flat" a connecting rod is attached adjustable in length, and connecting the radial rod with a crank, the revolution of which causes the rise and fall or vertical motion of the "flat," thus a double movement is given to the "flat," one horizontal by the guide, and the vertical one by the crank and connecting rod. The grinding cylinder may be placed between two flats thus arranged, and such apparatus as described be employed on each side.

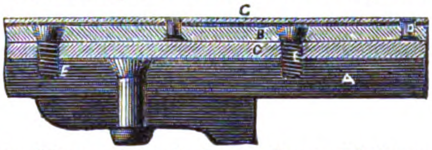
In the accompanying drawings, fig. 1 represents an end elevation of the apparatus for grinding and pointing the cards termed "flats" employed in carding fibrous materials, such view showing particularly the curved slot, by which means the shape into which the surface of the "flats" are to be ground is defined and regulated, and also shows one method of applying a reciprocating motion; fig. 2 is a front elevation, a portion being removed at the line A, B, in order to exhibit more clearly the gearing and internal construction.

In figs. 1 and 2, *a*, *a*, is the framing of the machine, in which is supported the driving shaft *b*, which drives by means of the strap and pulley *c*, a right and left-handed screw, and causes the roller and cylinder *d* to traverse from end to end of the two flats *e*, *e*, the application of this traverse motion and the means of effecting it being now well known, and the peculiarities and features of the grooved roller are explained in the specification of Letters Patent granted to Messrs. Allen and Johnson, dated January 24, 1863. The grinding roller *d* may either be used and constructed as therein described, or it may be employed without a corrugated surface as hitherto used, and is situated between the two "flats" to be ground, which are secured at the ends of the vibrating bars *f*, *f*, one end of such bars being supported in the bearings *g*, *g*, and are self-adjusting therein by being simply attached to the cord or weight which allows of any slight rise and fall. The course or curve which these bars, and consequently the "flats," are caused to follow, is regulated and defined by means of the curved (or straight) slots in the guides *h*, *h*; the surface of such flats are ground into a form corresponding to the form of the guide employed. The pressure of the flats against the grinding roller is obtained by means of the springs *l*, *l*, the amount of pressure being regulated by the ratchet and pawl *l*, by means of which the flats *e*, *e*, are prevented from becoming pressed too closely upon the grinding roller. The grinding roller is driven by means of the band and pulley *c* from the driving shaft *b*, and the vibratory motion or rise and fall of the bars and "flats" is effected by the crank studs on the spur wheels *m*, *m*, which are driven by a pinion on the driving shaft. The advantages arising from the employment of "needle-pointed" cards in the carding engine instead of the "chisel-pointed" as usually ground, together with the use of "flats" having their carding surfaces grooved truly to any required form, will be evident to all persons conversant with preparing and spinning cotton.

PALMER AND M'INTYRE'S METHOD OF APPLYING METAL SHEATHING TO IRON SHIPS, &c.

THIS invention, by Mr. C. M. Palmer and T. M'Intyre, of Jarrow, shipbuilders, has for its object the application and fastening of copper, "Muntz metal," zinc, or other metal used for the purposes of sheathing, to the bottoms of iron ships or vessels, and also to the iron used for other purposes, such as caissons, fortifications, or graving docks, in which it is liable to fouling by exposure to sea water or from other causes; and this invention consists in fixing to the iron plates of the ship or vessel, or to iron for other similar uses, strips of metal, by preference of galvanized iron, in which strips, are inserted rivets of copper or other suitable soft metal, such rivets protruding from the strips in such a manner as to admit of sheets of copper, "Muntz metal," zinc, or other sheathing, previously punched, being applied thereto and held thereby as required. By this arrangement the strips fixed to the vessel form carriers for the sheathing, and obviate the necessity of perforating through the ship's side. The strips are double—that is to say, there is one outer and one inner strip, and they are applied to the plates of the vessel by means of screws or rivets passing through both strips, and into the plates, the copper rivets having been previously inserted in an opposite direction in the outer strip. The sheets of copper or other sheathing are put on to the projecting copper rivets with their edges overlapping, so that the ends of two sheets are held by one row of rivets, and tarred felt, "blair," or other similar non-conducting material is inserted between the iron plates of the vessel and the copper or other metal sheathing. The projecting portions of copper are then hammered so as to securely rivet them.

The drawing is a vertical section of a portion



of a side vessel sheathed according to this invention.

A, A, are the plates; B, C, are the outer and inner strips of metal, which we prefer to be of galvanized iron. These strips have holes bored or punched in them at distances of about 3 in. apart, the side of the outer strip B having its holes countersunk to suit the countersunk heads of the rivets, and the two strips are rivetted together with the rivets D protruding beyond the outer strip B, the rivet heads being between the two strips. The strips are then fastened by screws or rivets E to the bottom and sides of the vessel, the plates A not being perforated but only entered, as shown. If the strips are to be rivetted, the holes are bored with a drill so constructed that it will be widest in the inside, so

that when the rivet is driven in it will expand and become quite fast. The space F between each pair of strips on the vessel's bottom and sides will be about ¾ in. deep, and is filled up with tarred felt, "blair," or other suitable non-conducting material, after which the entire surface is covered with a coating of gutta percha, and then the sheets G of copper, "Muntz metal," zinc, or other sheathing, previously punched as required, are applied to the rivets projecting from the strips and rivetted in the usual manner. The ordinary angle-iron frame of the vessel is represented at H. The strips can all be prepared ready to put on to the bottoms or sides of ships or vessels should repairs be necessary in a foreign port.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

SIR,—Can you or any of your correspondents give me, through the medium of your invaluable journal, any information on the following matters?—

1st. What is the quantity of atmospheric air consumed during combustion by a cubic foot of coal gas; and what is the volume of the products after combustion—all, of course, estimated at common atmospheric pressure?

2nd. What is the heating power of a cubic foot of gas—that is, what quantity of water will be raised, by the combustion of a cubic foot of gas, from, say, the temperature of 62 deg. Fahr. to the boiling point; and, also, what quantity would it actually convert into steam?

For any precise information on these questions I would be thankful.

I am Sir, respectfully yours,

MANCUNIENSIS.

Manchester, November 4, 1863.

RECEIVED.—M. M., I. F., W. C. and Co., D. K. C., W. J. J., I. K., I. H., Capt. L., W. W., J. N., I. H. R.

V. SMITH.—No chemical process will prevent the softening of gutta percha by the action of water sufficiently heated. You had better send post-office orders to Mr. Woodcroft if the sum is above five shillings. The postage will depend on the weight of the specification.

COLOUR.—There is a work of the kind you require, published in Weale's Rudimentary Series.

A SUBSCRIBER.—Any one who pleases may call himself a Civil Engineer. Legitimately, only those who have served a regular apprenticeship, so to speak, have a right to the title. In order to become a Member of the Institution, you must be more than twenty-five years of age, have been regularly educated as a Civil Engineer, according to the usual routine of pupilage, and have had subsequent employment for at least five years, in responsible situations, as Resident Engineer or otherwise, in some of the branches defined by the charter of the Institution as constituting the profession of a Civil Engineer; or, a candidate must have practised on his own account in the profession of a Civil Engineer for at least five years, and have acquired a considerable degree of eminence in the same.

C. B.—Your first letter was in type before the second reached us. Shall we insert it next week?

ERRATUM.—In a letter on Boiler Explosions in last week's MAGAZINE, for the "625th page" of the *Encyclopædia Britannica*, read, "635th page."

Correspondence.

GUNNERY AND ARMOUR PLATES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—It would ill suit me the task, and it would ill become me to indulge the idea of making your publication the medium for instructing your correspondent "Civilian" in the elementary principles of the science of mechanics; and yet until "Civilian" has cultivated an acquaintance with them—nay, until he has learned the language in which they are expressed, commencing even with the very alphabet thereof—it would needs be a farcial pleasantry to engage him in a discussion on scientific matters; neither is "Civilian" a modest man, or he would not say in opposition to what everybody else says, "I call velocity the *vis viva* because it is active, and I call weight the *vis inertiæ* because it is passive." Where and what are his credentials to warrant such an attempt to pervert the language of science, and in a manner, too, that betrays confusion in his mind as to those just ideas and distinctions concerning the realities of things, which it has taken thoughtful men so long a time to elucidate, and which they have long since stamped in words? Newton called a certain power in bodies as measured by the mass and the simple velocity, "quantity of motion;" but "Civilian" says "the quantity of motion" refers to velocity only. Since Newton's time the word "momentum" has been universally appropriated to this power and the said measure thereof; but "Civilian" says, "By momentum I mean the force of the moving body as represented theoretically [why theoretically?] by the square of the velocity multiplied by the weight." I have a faint suspicion that the authorities are against him, even that much-to-be-respected authority in all scientific matters to which he appeals—"the sense of words in their obvious and popular meaning." In the next paragraph, however, he says, "Equal quantities of momentum, products by calculation of varying quantities of velocity and weight, ought," &c. Now, which language are we to accept as the revelation of his ideas concerning the measure of momentum? And yet "Civilian" is the man to say that "precision of language . . . . is an object essential to fair discussion."

I pass on to a point more worthy of notice, because implicating experiments and facts, in regard to which persons more astute than "Civilian" may easily be led astray. But facts, as I before have had occasion to inform him, must receive a careful interpretation, embracing all their circumstances, before they can be taken in evidence for or against a principle. "Civilian" says triumphantly, "I will not give an opinion; I will confute him with facts;" but facts do become, through *his* interpretation of them, his own individual opinions, and, as such, they are not very likely to confute me. A man of a Mediæval turn of mind—that is to say, a man who substitutes fancies and loose slip-shod inferences for a severe investigation of things—has it in his power to point to very glaring facts in favour of a principle of levity antagonistic to that of gravitation. I am as enthusiastically in favour of facts, experiments, and practical knowledge as most persons, and, indeed, more so than meets the approval of the mere scientific man, relative to the comparative value of science and practice; but, on the other hand, I am bound to admit what the just cited instance, concerning the principle of levity, illustrates that facts are stubborn things, only as they are viewed in the light of true philosophy as founded on a far more comprehensive induction of other facts, and only so far as they are made the subject of strict examination under every aspect in which they can be presented.

The facts which are so signally to confute me, refer to the results of certain artillery experiments made at Shoeburyness; and the proposition advanced by me, which they are cited to demolish, is this; that, everything else being the same, the penetration of projectiles will be deepest where the material is most immoveable. Now, this proposition is a direct conclusion from the fundamental principles of mechanics, and is not to be shaken by ill-appreciated facts and experiments. Nay, the principal involved is universally acted upon, instinctively, as it were, by all artizans. Do we not find a difficulty in driving a nail in the middle of a board, when, being firm only at the ends, it vibrates to the blow? Do we not bring a heavy hammer on to the head of a nail or a rivet, when with a lighter one we wish to clench the one or batter down the end of the other? And do we not find, that, besides the utility of this expedient in preventing the nail or rivet being driven back, the effects of percussion are greatly intensified? Does not the blacksmith punch his iron on the firm anvil, and place it over a hole only when he drives out the detached piece? Do not our engineers seek to rival each other in the massiveness and immoveability of their anvils under the stroke of the steam hammer? Do they lay down as a foundation for such anvils a stratum of wool-sacks, or a bed of concrete? All practice testifies to the greater efficiency of percussive action, in overcoming, in various modes, the cohesive force of materials, in proportion as they are rendered firm and immoveable; and science, if asked, can tell the reason why. Even common sense dictates to the workman that he must not dissipate the force of the blow, in producing extraneous movements which he does not intend, nor movements of any kind in bodies on which he does not wish to operate.

Now, what are these artillery experiments, and these confuting facts by which "Civilian" pretends to justify a resort to rigidity and immoveability, when the object is to *diminish* the effects of percussive action? Four armour plates were attached respectively to solid cast iron, to solid granite, to solid wood, and to slabs of cork and india-rubber material. Under similar circumstances, as to the projectile, the penetration was slight in regard to plates with the iron and granite backings, but right through them with the wood and cork backings. And so it ought to have been. It would be a strange thing, indeed, if cast iron and granite had not afforded more help, more auxiliary resistance, in aid of that of the plates, than wood or cork. What was really put to the test was the strength of the several plates and that of their respective backings combined. If a ship can bear the weight, let iron and not wool be the immediate backing by all means; and then, by means of a wooden structure behind, let a certain degree of mobility be given to the whole, iron backing and all. But this is just the same as having the armour plates all the thicker by the thickness of the iron backing, only that the latter would be much better incorporated into the plate itself, when it would need no prophet to inform us, that a 6 in. plate would be more efficient than a 4 in. one. A mere thimble-rig trick is this figment about some particular value attaching in some prodigious degree to an iron backing. The weight and strength of iron being given, the pea is here if it is not there, or there if it is not here. Of course there is, in some moderate degree, a worse and a wiser choice in the disposition of the iron; but I give my vote in favour of a greater thickness in the plate.

Now, my proposition regarding the greater penetration incidental to rigidity and immoveability, embraced this proviso, that everything else should be the same; but in these experiments, everything was different, the plates being strengthened severally, by materials differing so greatly in powers of resistance, as cast iron, granite, wood, and cork. And yet "Civilian" is so little acute in analyzing and interpreting facts, as to say, "Everything else (but the yielding nature of the materials) was, as Mr. Cheverton desires, the same." A very peculiar sameness truly, when "everything else was the same *but*" the very materials which, as backing, imparted immensely different degrees of strength to the plates; for the rigidity or yielding of those materials indicated precisely the value of the auxiliary assistance afforded! To have everything else the same, there should be no backing at all; the use of rigidity or mobility should be tested, by having those qualities in the frames in which the plates should be set; or else, the plates should be so thick, that given shot should not only be unable to penetrate them, but be incapable of raising a bulge on the opposite side. The backing would not then be influential in direct resistance, but operative only in the desired direction of supplying different degrees of yielding and mobility. Each mode of experimenting would have its special advantages in the character of the results, rupture or simple indentation. I have not the slightest doubt that my proposition would be found to be correct—that, *cæteris paribus*, the depth of indentation is the greatest where the material is most immoveable. Else, indeed, all deductive reasoning, logical and mathematical, from firmly established natural principles, is a delusion and a snare.

The artillery experiments certainly present a specious side by which loose reasoners may be led, and misled, to adopt "Civilian's" conclusion, of "the superiority of rigid over elastic or yielding resistance to projectiles;" but I shall greatly be surprised if any man of scientific pretensions should fall into this error. Still, there is always an illusive speciousness about conclusions founded on experiments, although they may be ill-appreciated and falsely interpreted, and, therefore, I have not done wrong, I think, in debating a little upon this point; but, as to other points noticed by "Civilian," it will not be worth while to enter into further exposition.

Yours, &c.

BENJ. CHEVERTON.

[N.B. We have curtailed the latter part of this letter to avoid, if possible, entering on a personal controversy.—ED. M.M.]

BOILER EXPLOSIONS.

SIR,—Mr. Colburn leaves my last letter substantially unanswered. In writing the article, "Steam Engine" for the *Encyclopædia*, I stated that I had "consulted" the *Engineer*, as well as other works which are named. My "former as-

sistant" has been, and is, in Mr. Colburn's employment. I deny using the peculiar language imputed to me.

I thank you for the space you have allowed me; and I repeat, the question in discussion is scarcely suitable for your columns, and had better have been referred to competent persons,

Your obedient servant,
D. K. Clark.

11, Adam-street, Adelphi, W.C., Nov. 3, 1863.

STEERING BY TWIN-SCREWS, &c.

Sir,—Your Magazine almost weekly brings me vexation and disappointment, in the matter of my inventions adopted by others:—firstly, the auxiliary rudder, or side fins, for steering or stopping a screw steamer; secondly, propelling and steering by the single screw, as lately tried in H.M.S. "Charger," at Sheerness; thirdly, steering by twin-screws, as tried in H.M.S. steam launch "Experiment," at Portsmouth.

Most persons who take interest in nautical matters, know there is nothing new in twin-screws; but steering by twin-screws, as first fitted with separate engines to back, stop or reverse either screw at will without interfering with the other, so as to turn a screw steamer in her own length, was first made public in my experimental vessel "Ichthyon," on the Serpentine, in October, 1860, as witnessed by thousands, and noticed by the *Times*, *Daily News*, and certified to by Admiral Fletcher, Captain Target, and others.

I trust to your sense of justice to publish these facts in your Magazine.

I am, yours obediently,
George Beadon.

Creech Barrow, Taunton,
October 31, 1863.

Meetings for the Week.

Mon.—*Royal Geographical Soc.*, Sir R. Murchison, K.C.B., in the chair, 1, "On the Snowy Mountains of Eastern Equatorial Africa," with map, by Baron Charles von der Decken. 2, Last letter of the late Mr. Richard Thornton to Sir R. Murchison from Sheepanga, on the Zambesi. 3, The Niger Expedition—latest intelligence from Dr. Baikie. 4, Letters of the late Dr. Vogel, from the interior of Africa, at 8.30 p.m.
Medical Soc., at 8.30 p.m.

Tues.—*Inst. Civil Engineers*, "Description of Lighthouses lately erected in the Red Sea," by William Parkes, Esq., at 8 p.m.

Thur.—*Antiquaries*, at 8 p.m.

Sat. — *Architectural Assoc.*, "On Dwellings of the Poor, by H. A. Darbishire, Esq.

Miscellanea.

During the past week 39 wrecks have been reported, making a total for the present year of 1871.

The Lords of the Admiralty have ordered the removal of the Muntz's metal from the bottom of the iron-cased screw steamship "Royal Oak."

Some idea may be obtained of the costliness of the new railway improvements in the metropolis, when it is stated that the extension of the South-Western line from Nine Elms to the Waterloo-road —a distance of one mile— amounted to £1,000,000. It is estimated that the new line in London will cost on an average about £600,000 per mile.

On Monday a new monster dredging machine, very much more powerful than any hitherto employed on the Thames, was put to work, by order of the conservators of the river Thames, at Blackwall, in removing an excessively hard shoal formed of conglomerate gravel, which has hitherto resisted every effort made to rid the navigation of that important part of the river of so formidable an obstruction. The impediment, however, is giving way under the operation of the new machine, the engines of which are of 50-horse power. The new machine will be regularly employed in dredging and deepening other parts of the river, both below and above bridge, so soon as the shoal off Blackwall is removed.

Mr. L. Stebbins, of Worcester, Mass., has invented a sub-draining railway pavement, with which he proposes to cover the entire area of streets. It is made of iron; each block about 2 ft. square on the surface, and 2½ in. deep. There are four keys or square bolts to each square foot of surface. These keys rise ⅛ in. above the surface, and yield to the pressure of the horse's hoof. Each key rests on a rubber spring, which is secured in an iron tube. The inventor claims that it affords the best known surface for wheels to roll on; renders the slipping of horses impossible; and prevents, to a great extent, the accumulation of dirt, reducing the expense of cleaning streets

Two muzzle-loading 12-pounders, similar to the first Whitworth 12-pounder sent to the Royal Arsenal, have been received for trial, together with some cylinders with which to prove these guns. The peculiarites of these 12-pounders, which were specially made for the competitive trial against the six 12-pounders of Sir. W. Armstrong, similarly prepared, are that the vent is placed in the rear, instead of its usual place at the top of the gun, and that the angles shown in former rifling are swept out, leaving six rounded grooves. Against these three Whitworth 12-pounders, made out of blocks of mild steel, there will be tested by the Armstrong and Whitworth Committee, first, three breech-loading finely grooved Armstrongs, and three muzzle-loading Armstrong 12-pounders, rifled on his latest improved shunt plan. When this trial—which will be a most lengthened one—is concluded, another step in the competition will be taken and larger guns tried, probably three of the next calibre by Whitworth and six more by Armstrong, as he seems still in doubt whether brass buttons or zinc bars let into the shot form the best bearing for sizes above 12-pounders, and will, therefore, probably have three of each. One thing is, however, clear from this that Sir William not only mistrusts the breech-loading arrangements, but also his own especial plan of the inner tubes of coiled iron (both are unfortunately used in all the Armstrong guns in the service), for he relies upon his new "muzzle loader" for success, and has given his six competition 12-pounder steel tubes, or rather steel barrels, which are then finished with coils at the breech.

A prospectus has been issued of the National Steam Navigation Company, with a capital of £2,000,000, in shares of £100. The object is to accelerate the substitution of powerful screw-steamers for sailing vessels in the American and other trades; and the first step will be to establish lines from Liverpool to New York and from London to New York, of steamers of large size and great capacity, fitted for carrying grain, flour, provisions, and all other kinds of freight, and also for the conveyance of passengers. Three new steamers have been provisionally purchased, and contracts have been entered into for the building of others of about 3,500 tons each.

Considerable deposits of sulphur have lately been discovered in Corfu. This is but one of many significant facts cropping up, tending to show that the mineral resources of the Grecian and Ionian Islands are a "great unknown," awaiting but the establishment of order and confidence in the inhabitants to be manifested.

M. J. Giordano has described to the French Academy of Sciences an instrument, called by him a *bathoreometre* (depending, as to principle, on the closing of an electrical circuit by means of a substance interposed between the electrodes), whereby he is able to determine, with great exactitude, the thickness of very thin substances. A single thread of the silkworm was found to have a thickness of 0·014 of a millimetre; that of a spider (such as is used to divide the field of the telescopes), 0·037 mm. Hair from an infant's head is 0·009 mm., that of an adult averages 0·047 mm., in thickness. French gold-leaf has a thickness of 0·009 mm. A film of mica was obtained so wonderfully thin as 0·003 of a of a millimetre, or about twelve-millionths of an inch.

The target ordered to be constructed on a new principle, and with armour-plates of increased thickness to those at present in use, in order to enable the officials at the Admiralty to decide on the size of the plates with which the new iron frigate "Bellerophon," which has been commenced at Chatham, shall be coated, is to be erected at Shoeburyness, under the superintendence of Mr. Baskcomb, one of the officials from Chatham Dockyard. The principal object in having the target built is to test the strength of the timber backing and plates on the plan on which it is proposed to construct the sides of the "Bellerophon." To effect this the foundation of the target will consist of iron frames 10 in. in thickness and about 2 ft. apart, covered first with iron plates 2 in. in thickness, and afterwards with a backing of teak 1 ft. thick. The 6 in. armour-plates will be laid on the teak planking, the whole thus forming a target of immense strength. From the calculations already made, it is expected that this construction of side for the "Bellerophon" will surpass in shot-resisting strength every other system hitherto adopted in this country; and should the trials prove satisfactory, the "Bellerophon" will be formed in this way from stem to stern. The mechanics employed in the smithery at Chatham Dockyard are now engaged in making the heavy forgings for the "Bellerophon," in readiness for laying down the keel of that vessel in No. 2 dock; the "Achilles," which now occupies that dock, having been ordered to be ready for floating out by the 26th of December.

On Monday the British and Magnetic Telegraph Company successfully laid a submarine cable across the Bristol Channel at New Passage. This cable, which contains several wires, is intended to enable the Bristol and South Wales Union Railway Company to communicate from the Gloucestershire to the Monmouthshire shore, and *vice versa*, the Telegraph Company laying down additional wires, in order to afford greater facilities for the increasing business requirements between South Wales and Bristol.

American advices state that the Norfolk Navy Yard, which the rebels destroyed, has been in a great measure restored, at least so far that vessels-of-war are now repaired and altered at that station. There has not been much money expended on it, for a prejudice seems to exist against it; but Government officers, out of the ruins, have reconstructed the dry dock and converted the old pump into a new one at comparatively small cost. Nine vessels-of-war are now at the station undergoing repairs or being converted into "double-enders," and twenty-two have been altered and repaired. The wants of the service have been so exacting that everyplace where ships could be built or repaired has been required for Government use, and the Norfolk yard has forced itself into favour in consequence.

One of our exchanges says that there is considerable excitement just now in business circles connected with the Lake Superior trade, in consequence of the discovery of an immense deposit of silver-bearing lead in that famous region. It is stated that the ore yields 20 per cent. of pure lead, and that every ton of lead yields 25 lbs. of silver.

A great many English blockade-runners are now in New York overhauling and refitting, preparatory to being placed on the blockade. "Set a thief to catch a thief," on the old principle, we presume, of "setting a thief to catch a thief."

The Prime Minister is just now the subject of a considerable amount of scandal. But, judging from the extraordinary antecedents of the plaintiff's solicitors, we expect the affair will turn out a scandalous hoax. This "respectable firm of solicitors" owed us £2 5s. 6d. for advertising, and, after sending at least half-a-hundred times for the money, over a period of a year and a half, we had to summon them before the Sheriff's Court. They accordingly paid the money with the necessary costs. Many other papers in London could tell a similar tale, even the *Morning Star*, which first gave currency to the unfragrant rumour, included.

The Docks' Committee of the Bristol Town Council held a meeting on Saturday for the purpose of considering the scheme for river improvement which was debated at a former meeting. Mr. Howard, the Docks' engineer, brought forward a plan, which, in obedience to a resolution of the committee, he had prepared for improving the entrance to the Cumberland-basin, and thence to the Floating-harbour, and also of removing some objectionable features of the Avon. Mr. Howard proposes to cut off some of the points by which the tidal river is now rendered so tortuous, and by new and capacious locks, to enable ships of large burthen to enter the basin with greater facility and safety. He recommends that a new and commodious lock, with deep sills, should be cut through the piece of land which forms the south front of Jones's Coal-wharf, into Cumberland-basin, to enlarge the area of that dock, and to build a new wall on the north side of it; and then to cut a large and convenient lock through the slip at the eastern extremity of the basin, so as to admit of vessels being hauled in nearly a straight line into the part of the Float known as the Sea-banks. Mr. Howard estimates the cost of his proposed works at £320,000. The consideration of the scheme has been adjourned.

Some trials of a highly interesting character took place on the Royal Engineers' field-works, Chatham, on Tuesday week, in the presence of a large number of officers, for the purpose of testing a new description of suspension-bridge, for military purposes, the invention of Sergeant-major J. Jones, Royal Engineers. The bridge on which the experiments were made was formed of the galvanized iron

bands with which the new description of iron gabions now in use in the service are formed. These bands, which are about three inches in width, and the 30th part of an inch in thickness, were joined together at the end, by means of a button and eye, and, notwithstanding the apparent slenderness of the material, bore an enormous weight. Eight widths of the iron bands, each four bands thick, formed the "chains" of the suspension-bridge, and on these were laid the chesses, used in pontooning, which served as the floor of the bridge, the whole being steadied by means of guy ropes, fastened to stakes, answering to anchors in a river. With these materials a bridge having the enormous span of 130 ft. was formed by 30 sappers and miners in 6 hours. A battery of mounted field artillery was marched across with the greatest ease, the bridge having only a slight oscillation. A body of about 80 Royal Engineers was next marched across, in step; and this was the greatest strain to which the structure could be put. Notwithstanding this, however, the only perceptible defect was the great oscillation of the bridge, which ultimately loosened one of the guide ropes. In order to show the strength of the bridge a field gun with carriage, limber, and ammunition cart complete, was next wheeled across it, when gun, carriage, and men passed over without the bridge giving any sign of weakness. Some other experiments were also tried, all of which were exceedingly satisfactory, and proved the great value of bridges of that kind.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Boilers and Furnaces, 796, 816, 842.
Buildings and Building Materials, 789, 804.
Chemistry and Photography 821.
Cultivation of the Soil, including agricultural implements and machines, 807, 810, 822.
Electrical Apparatus, 830.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 785, 793, 798, 803, 805, 811, 820, 827, 828, 833.
Food and Beverages, including apparatus for preparing food for men and animals—*none.*
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 790, 792, 813, 814.
Letter-Press Printing—*none.*
Lighting, Heating, and Ventilating, 815, 817.
Metals, including apparatus for their manufacture, 783, 784, 788, 795, 802, 818, 819.
Miscellaneous, 824, 826.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 799, 808, 809, 812.
Ships and Boats, including their fittings, 786, 829, 831.
Steam Engines, &c., 825.
Warfare, 787, 797.

783. J. H. Johnson. *Improvements in the manufacture of zinc, and in apparatus employed therein.* (A communication.) Dated March 25, 1863.

This invention relates to the manufacture of zinc in blast furnaces, and consists of certain improvements in connection with the processes of smelting and of condensation. According to this invention, it is proposed that the fuel employed shall be raised to a high temperature in special furnaces before being supplied to the blast furnaces, which are to be closed at the top, and provided with a suitable cover or plug. This furnace is filled with fuel only, although if desired the ore and flux may be charged at the top of the furnace with the fuel; but according to this invention it is proposed to supply the furnaces with the ores and fluxes in a state of division by blowing the same into them through one or more blast pipes or tuyeres, the temperature of the ores and fluxes having been previously raised in suitable furnaces, kilns, or hearths. *Patent abandoned.*

784 T. W. Gore. *An improved method of uniting earthenware, metal, and other pipes.* Dated March 25, 1863.

This invention consists in uniting earthenware, metal, and other pipes formed with flanges on the ends thereof by means of a grooved collar formed in two or more parts. The ends of two flanged pipes which are to be united are laid in the lower half of a circular collar with a groove in the inner face thereof in which the flanges fit, the joint being made further tight if necessary by washers, cement, or packing. The other half of the circular collar is then passed over those parts of the flanges, not received within the lower half, and is made to fit on the edges of the lower half. For further security, if desired, a clamp or clamps may be fixed on the collar. *Patent abandoned.*

785. R. A. Brooman. *Improvements in the manufacture of cords, ropes, and cables, and in machinery employed therein, applicable also to spinning, winding, and twisting fibrous and filamentous substances.* (A communication.) Dated March 25, 1863.

This invention is not described apart from the drawings. *Patent completed.*

786. G. T. Key. *Improvements in fog signals.* Dated March 25, 1863.

This invention consists in the application of bellows to sound a wind instrument, such as a fog horn, the horn entering the bellows and forming the spout, or two or more differently sounding wind instruments—as, for example, a fog horn and whistle, for signalling during fogs and at other times. The bellows may be made in different ways—as, for example, single-acting, such as those in ordinary use for blowing fires, or double-acting, such as those used by blacksmiths. *Patent completed.*

787. L. Christofleau. *Improvements in firearms.* Dated March 26, 1863.

This invention is intended to be applied especially to sporting guns, and gives to firearms a greater security, and will prevent the numerous and fatal accidents which occur from the accidental discharge of firearms. The patentee takes off the trigger which, by projecting from beneath, may catch some impediment and cause the cock to fall upon the exploding cap, although the trigger is protected by the trigger guard, which is no longer wanted. No other piece but the cock is left to project, and as nothing can indirectly act upon the lock to remove the cock stop, the cock can no longer come down accidentally, and the less so, inasmuch as this trigger, which is even with the stock, and no longer underneath but on the upper part, is protected by a little sliding plate, which must be removed before the trigger can be pressed upon to fire the gun. The said trigger drives the end of a swing lever, the other end of which lifts the catch or stop which is engaged in a notch of the nut when the gun is cocked, the main spring working as in common gun-locks; the cock or hammer falls suddenly on the cap. *Patent completed.*

788. J. Mushet. *An improvement or improvements in treating steel and iron prepared by the pneumatic process.* Dated March 26, 1863.

The essence of this invention consists in thoroughly mixing, without the agency and deteriorating effects of the pneumatic blast, melted speigel eisen, or other melted alloys—such as alloys of tungsten of iron, or titanium of iron—with melted steel or malleable iron, prepared by the pneumatic process from melted pig iron or cast iron, which mixing the patentee effects either by the use of two or more pneumatic or decarbonizing vessels, each containing melted steel or malleable iron made by the pneumatic process, to the steel or malleable iron, in one or both of which two vessels the melted speigel eisen or other melted alloy has been added, the contents of one vessel being poured into the other vessel so as to internally mix and make the whole of uniform composition. Or by the use of one working pneumatic vessel, or of two or more working pneumatic vessels, in which the steel or malleable iron to be operated upon has been produced by decarbonizing melted pig or cast iron by the pneumatic process, and another or supplementary pneumatic vessel or pneumatic ladle, which, previous to use, has been intensely heated by having had pig or cast iron decarbonized in it by the pneumatic process, the melted speigel eisen or other melted alloy with which the steel or iron in the working pneumatic vessel or vessels is to be mixed being introduced into the heated pneumatic ladle, and the melted steel or malleable iron in the working pneumatic vessel or vessels being poured into the pneumatic ladle, and thereby intimately mixed with the melted speigel eisen, or other melted alloy contained in the said pneumatic ladle. Or the whole of the melted speigel eisen or other melted alloy may, after the blast has been withdrawn, be introduced into one of the said working vessels, each containing melted steel or malleable iron prepared from pig or cast iron by the pneumatic process, and the contents of the one pneumatic working vessel or of the several pneumatic vessels may then be poured into the intensely heated pneumatic ladle, whereby the melted steel or malleable iron and the melted speigel eisen or other melted alloy will, by the commotion of their particles, become thoroughly and uniformly mixed without the oxidizing and injurious effect produced when a blast of air is employed to effect a mixture of the before-mentioned melted substances. *Patent completed.*

789. G. Cowdery. *Improvements in machinery for making bricks.* Dated March 26, 1863.

This invention is not described apart from the drawings. *Patent completed.*

790. M. L. Parnell. *Improvements in the construction of locks, and in the method of adjusting their spindles.* Dated March 26, 1863.

The object of these improvements in the construction of locks is to prevent the stump in the bolt of a lock being pressed back against the cheeks of the levers, to detain false keys or picks by means of a detector or contrivance, to release the same without injury, and an easy mode of adjusting the knobs to the spindles of the same. *Patent completed.*

791. N. R. Hall. *Improvements in the construction of weighing apparatus.* Dated March 26, 1863.

This invention is based on the principle of the common steelyard, inasmuch as the article to be weighed is suspended at the short arm of the lever, but differs otherwise; for, instead of ascertaining the weight of an article by shifting or sliding a given weight upon the long arm until it is perfectly horizontal, the patentee allows the weighing apparatus to come to rest in any position, according as the weight of the article may draw it more or less from the horizontal line, and he then discovers the weight of the article sought by means of a hand which points to various figures representing weights, which said figures are marked upon a circle. This circle is at the extremity of one end of the weighing apparatus, and at the centre of this circle or dial the hand moves or plays freely upon a stationary pin, and the hand having a heavy tail end it will always maintain a perpendicular position when in use, and will, therefore, be directed to that number which is brought to a vertical position with the centre of the circle or dial. At the proper end for attaching the article to be weighed there is a suitable clip with hooks (or any convenient contrivance may be used) for attaching the article to be weighed; and when this weighing apparatus is hung or held up for use with the article properly suspended, the circle or dial will rise more or less, and one of the numbers marked upon it will be brought to a vertical position, to which said number the hand will be directed, and thereby indicate the weight of the article. *Patent completed.*

792. W. Johnson. *Improvements in pocket-books, purses, wallets, and bill-cases.* Dated March 26, 1863.

This invention consists in constructing pocket-books, purses, wallets, and bill-cases in such manner that the mouth or entrance into the compartments therein shall be kept closed until drawn open by the hand, whereby the contents of such compartments are prevented from falling out. The manner in which the patentee carries his invention into effect is by attaching one or more metal clip springs at the base with arms rising up the sides of the compartment, the mouth of which is to be kept closed as aforesaid. *Patent completed.*

793. T. Parkinson and J. Wood. *An improved application of embroidery to cotton printed fabrics.* Dated March 26, 1863.

This invention is designed to produce an economical substitute for the embroidered fabrics hitherto made of expensive material, such, for instance, as that class termed embroidered Bradford goods; and the improvement consists in embroidering with silk cotton fabrics which have previously been printed by ordinary processes to resemble or imitate better fabrics, so that, by the application of silk embroidery to cotton fabrics so printed, a novel manufacture is produced, wherein good appearance may be cheaply procured. *Patent abandoned.*

794. W. Tod and R. Paterson. *Improvements in portable apparatus for working drills and other instruments.* Dated March 26, 1863.

This invention relates to portable apparatus to be actuated by water or other fluid transmitted by tubing, for the purpose of working drills or other instruments which it may be desirable to move about from point to point. *Patent abandoned.*

795. G. Davies. *Improvements in engraving upon metals.* (A communication.) Dated March 26, 1863.

The principle upon which this invention is based is the application to engraving of the following well-known theory—that is to say, that when a certain metal is plunged into a saline solution containing a metal of the same kind, the solution is decomposed, and the metal reduced is precipitated on the former with a considerable degree of adhesion. It is the application of this principle to the art of engraving which the inventor wishes to secure to himself, without reference to the method of biting in, and although he gives the preference to certain solutions and certain plates, yet he can work equally well upon tin, copper, silver, or other metal by employing a solution belonging to a superior section to the metal—that is to say, a solution of a metal capable of precipitating itself thereon. *Patent completed.*

796. J. H. Johnson. *Improvements in furnaces or fireplaces, and in apparatus to be used in connection therewith.* (A communication.) Dated March 26, 1863.

This invention has for its object the obtaining of a better and more perfect combustion of small or inferior coal or fuel in steam boiler and other furnaces or fireplaces, and consists, chiefly, in a peculiar arrangement of apparatus to be adapted beneath the grates or fire-holding portions of furnaces or fireplaces, whereby an increased supply of air is directed into the burning fuel by the number of steam jets. *Patent abandoned.*

797. J. Norton. *Improvements in projectiles or ignition missiles.* Dated March 26, 1863.

This invention relates to the arrangement and construction of projectiles or ignition missiles suitable for igniting any inflammable body with which they may be brought into contact. Under one modification or system of arrangement, the shell—which is made of any suitable figure externally—is charged with liquid phosphorus. This solution is prepared by dissolving phosphorus in a suitable quantity of the bisulphide of carbon, and to this solution may be added, if required, a proportion of benzole for the purpose of increasing the inflammability of the solution. The front end of the shell is made so that it may be pierced in its passage from the gun. This may be done by placing a plug in the muzzle of the gun; the inner end of this plug is pointed or made with a piercer that will perforate the shell. On the gun being fired, the shell is impelled against the pointed part of the plug, which is driven out by the force of the blow, and does not further impede the flight of the shell. In the passage of the shell the liquid phosphorus slowly escapes from the apertures, and ignites on coming in contact with the atmosphere, and continues burning until the whole of the liquid is consumed. *Patent completed.*

798. W. Blake. *Improvements in the manufacture of labels for luggage and other articles.* Dated March 26, 1863.

This invention relates to the manufacture, application, and use of what may be termed compound paper in the manufacture of labels, such as are used for luggage and other articles. The raw material which is preferred for this improved manufacture is what is technically known as ammunition or cartridge paper, which is a thin strong clear paper. Two or more sheets or layers of this paper are laid together, and attached to each other by means of ordinary adhesive paste or other suitable attaching mate-
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stance. This combined or compound paper is then rolled or otherwise treated with great pressure for the purpose of combining the sheets or layers into one solid mass. *Patent completed.*

799. F. APPLEGATE. *Improvements in railway carriage doors.* Dated March 26, 1863.

These improvements in railway carriage doors the inventor proposes to effect by using sliding doors instead of doors on hinges; the whole of the doors on both sides of the carriages (of course separate), or on one side, slide into recesses outside or inside, as preferred. He proposes to attach all these doors to a rod provided at the end of each carriage with a suitable expanding lining, or other mechanical equivalent, for connecting quickly, so that the guard at the end (or other compartment in which he is placed) can open all the doors at once when the train stops, and when the train has started to close them simultaneously. *Patent abandoned.*

800. E. EASTON. *An improved application of hydraulic apparatus for lowering full casks and other goods, and raising empty casks or vessels.* Dated March 26, 1863.

The chief object of this invention is to facilitate the deposit of barrels of beer in publicans' cellars, and the removal of empty casks therefrom. To this end, the inventor provides immediately below the trap or street entrance to the cellar a table or platform for receiving the barrels. This platform he mounts on a hydraulic ram, which works in a cylinder sunk in the ground to such a depth as will allow of the platform sinking to the level (or nearly so) of the cellar floor. *Patent abandoned.*

801. G. GRANTHAM. *Improvements in apparatus connected with machinery used in manufacturing compressed fuel.* Dated March 27, 1863.

This invention refers to machines with turn-tables or mould frames, upon which are affixed a certain number of moulds, and around which three operations are carried on nearly simultaneously—namely, 1, filling the mould with the small coal or other material; 2, subjecting the said material to the action of a hydraulic press for the purpose of solidifying or compressing it; 3, subjecting it to the action of another press for the purpose of discharging the block of fuel from the mould. The moulds are presented seriatim to these operations, and hitherto the turn-table has been moved by means of manual labour, which it is here proposed to effect by the use of hydraulic machinery. *Patent completed.*

802. W. M. MORGAN. *Improvements in coating metals, and in machinery and apparatus employed in coating metals.* Dated March 27, 1863.

The patentee claims—1, the use of fluxes consisting of chloride of zinc, or chloride of zinc and chloride of potassium, on the surfaces of baths employed for coating sheets or plates of iron and other metals with tin or lead, or alloys of tin and lead; 2, the general arrangement or combination of the parts of the machinery described and illustrated in the drawing for conducting the plates or sheets to be coated through the bath of melted metal. 3, applying to baths used for coating sheets or plates of iron or other metal with tin or lead, or alloys of tin and lead, at that side of the said baths from which the coated sheets or plates are withdrawn, two polished cast-steel, iron, copper, or other hard surfaces made to press upon the opposite sides of the coated plates or sheets, for the purpose of equalizing the quantity of metal on the coated plates or sheets, and smoothing the surfaces of the said coated plates or sheets as described. *Patent completed.*

803. R. A. BROOMAN. *Improvements in machinery for scouring wool.* (A communication.) Dated March 27, 1863.

This invention consists in the following arrangements of machinery for scouring wool:—The wool is supplied by a feeding apron or otherwise into one end of a long trough, and is taken hold of successively by a series of rakes or forks which are jointed to cranks carried by transverse shafts supported by uprights, which rise from the sides of the trough. Motion is communicated to the transverse shafts as follows:—The last transverse shaft is bent at one extremity, and carries a pulley which receives motion from a belt passing over another pulley, mounted on the same shaft as the main driving pulley; the motion thus imparted to this transverse shaft is transmitted to the other transverse shafts by means of bevel gearing and a longitudinal shaft. The wool being taken hold of by the rakes or forks as before mentioned, is conducted to the further end of the trough, where it is again taken hold of by another fork, which raises it out of the trough on to an apron, which leads it away to be pressed. This last-named fork is jointed to an axle which passes through the felloes of two toothed wheels, which receive rotary motion from pinions mounted on the principal shaft. The fork and a cam for raising it out of the trough revolve round two rollers, the fork is returned to the trough by a guide fixed to the sides of the trough, the operation is repeated as before, and so on successively. *Patent completed.*

804. J. TAYLOR, jun. *Improvements in the construction and arrangement of the rain-water pipes of buildings.* Dated March 27, 1863.

This invention has for its object the so constructing and arranging the rain-water pipes of buildings that they, and also the traps usually placed at their bottom ends, may be readily cleansed of any matters that may accumulate in them. For this purpose the patentee forms the lowest length of the number of lengths of pipe which together compose a rain-water pipe, and the bottom end of which descends into the trap, of greater diameter than the other pipes, in order that if there be any obstruction in the trap, or in the pipe, this lowest length may be slid upwards over the length of pipe above it, and thus leave a space between the trap and the lower end of the rain-water pipe; any matter that had accumulated in the trap can then be readily removed from it, or any obstruction in the pipe can be washed out at its end. The moveable length of pipe is formed with lugs or projections upon it, by which the pipe when raised can be held up, and by which also it is carried when in its lowest position. The rain-water pipes of buildings may also in a similar manner be made with one of the intermediate lengths of the pipe moveable; and this is a convenient arrangement when no trap is employed. For this purpose the length of pipe which is to be moveable is made of greater diameter than the other pipes, so that it may be slid over the pipe above, but at its lower end it is contracted so that it may there enter into the socket of the pipe below it. The moveable length of pipe is, as in the former case, made with projections upon it, by which the pipe when raised can be retained up. *Patent completed.*

805. W. CLARK. *Improvements in winding or copping frames.* (A communication.) Dated March 27, 1863.

This invention relates to improvements in self-acting and other winding or copping frames for spinning and twisting fibrous matters. The first improvement consists in replacing the sector or other apparatus for regulating the winding by a curvilinear section of a cone depending from the moveable carriage, and moveable on its axis; a chain passes round this cone, which is wound or unwound in proportion to the speed imparted to the spindles for producing the necessary number of turns. The second improvement consists in replacing the rule or copping plate conducting the faller in such machines by an apparatus similar to that before described, but, instead of having a chain to wind on and off the cone, the latter has a curvilinear surface in contact with an intermediate part suitably adjusted for imparting the necessary movement to the faller during the winding at the height necessary for the formation of the bobbin. The third improvement consists in replacing the scrolls or apparatus serving to produce the return motion of the carriage during the winding by an apparatus which permits of imparting a variable speed to the carriage by means of a cord or chain in connection with a combination of parts, to which is attached the one end of the cord or chain, the other end of the cord being acted on by suitable means for imparting a uniform speed thereto. The fourth improvement of this invention consists in imparting a recoil movement to the carriage during the pointing of the spindles, in order that the thread shall remain stretched without using a faller. *Patent completed.*

806. J. D. ASKWITH and G. GREENWOOD. *Improvements in rag machines.* Dated March 27, 1863.

This invention has for its object the separation of the untorn rags from the wool or fibre. This is effected by continuing, in the first place, the usual cover of the swift so that the rags (torn and untorn) are brought to the front part of the machine; and, secondly, by placing a casing of wood, or other suitable material, partly in front of and partly underneath the feed cloth of the machine. Within the casing the inventors place plates of wood or other suitable material in such positions that the untorn rags—by reason of the current of air created through the speed of the swift of the machine—are driven against them and fall down into recesses prepared for the purpose, whilst the torn wool or fibre is carried by the current of air through openings beyond the plates. *Patent abandoned.*

807. J. KING and T. H. MARSHALL. *Improvements in machinery or apparatus for preparing land for seed, and for harrowing and in fencing land.* Dated March 27, 1863.

In constructing machinery and apparatus for dibbling land, wheels are used with dibbles set on their peripheries. Such dibbles are arranged to be adjusted nearer to or further from each other, according to the distance apart at which it is desired to insert seed, and they are also each arranged in such manner as to have a movement when in the land in order to free them therefrom without breaking up and injuring the sides of the holes formed by them. It is preferred that a pair of such wheels should be mounted on the same axle, in such manner that they may be readily adjusted to and from each other, according to the distance apart it is desired to have the rows The axle carrying the dibble turns in bearings in a suitable frame. This frame at its centre is capable of turning on a short vertical axis, carried on the under side of a frame that is provided with shafts. The frame carrying the dibble wheels is provided with two handles or levers by which this frame can be inclined to the shafts, and the dibbles be thus steered or guided. The shaft upon which the dibble wheels turn is provided at each end with a rod which descends downwardly, and the lower ends of these rods, when the machine is at work, enter a short distance into the land, and thus, as the machine moves along, make lines along the ground. The machine can thus be readily guided by causing the rod on one side of the machine to be moved along the line previously made by the rod on the other side of the machine. In order that the machine may be drawn along a road or other suface without the dibbles coming in contact with such road or surface, the frame which is provided with shafts carries an axle on its upper side, which axle is provided with two road wheels. These wheels are of such a diameter that they shall be above the land when the dibble wheels are resting on it; these wheels can, however, be brought on to the land by turning over the shaft frame by means of the shafts; the dibble wheels will then be lifted off the land, as the rod upon which they turn will, by the frame having been turned over, be brought above the axle of the road wheels, in place of being below it. *Patent completed.*

808. B. W. GOODE. *A new journal, axle, or bearing, particularly applicable to rolls.* Dated March 28, 1863.

This invention relates to a new journal, axle, or bearing, by the use of which rolls, plain or with patterns cut or embossed upon them, may be changed with great facility without being obliged to take out the screws and brasses, as in the present usual arrangement, in which the rolls are solid or fixed on solid mandrils, and not, as in this invention, placed upon axles or mandrils revolving with the rolls. The patentee does not claim putting the rolls upon mandrils, solid or otherwise, but a more precise and effectual mode of fixing them, so that, when once fixed, they shall revolve perfectly true and correctly. The invention cannot be described without reference to the drawings. *Patent completed.*

809. A. H. PERRY. *Improvements in working railway points, switches, and signals, and in the apparatus to be employed for that purpose.* Dated March 28, 1863.

The object of this invention is to ensure to the pointsman or signalman a correct knowledge of the condition of the points or the signals (or both together, where they are connected and worked simultaneously) when either are worked or operated in one direction or the other, by which he will be enabled to work the traffic with safety over lines or junctions however complicated. For the purpose of ensuring the points or the signals being in the position intended or due to the movement of the lever handle by the pointsman, although he may be at a considerable distance from such signals and from the points, the inventor applies to each pair of points, and to the face or edge of the rail into which it is intended the point or tongue is to come in contact, a piece of copper or other suitable conducting metal, and by insulating each piece of metallic conducting surface from the rail or rails, and connecting it by means of a wire with a battery and telegraph instrument to the earth, the perfected contact is signalled on the opening or the closing of each pair of points or switches. *Patent abandoned.*

810. R. SIMS. *Improvements in reaping and mowing machines, part of which improvements is applicable to horse-works.* Dated March 28, 1863.

In carrying out this invention, the inventor employs an improved method of arranging the connecting rods of reaping and mowing machines, whereby the weight of the rod and its bush is removed from the crank pin to a guide or bush, such bush being situated at the rear end of the rod, the opposite or front end being formed of any convenient shape of joint for the purpose of attaching it to the knife-bar. In the aforesaid connecting rod, and at right angles to it laterally, he attaches or forms a slot for the reception of the crank pin which gives motion to the knife-bar. The slot is of any convenient length to admit of the throw of the crank, and of any convenient width to admit of a crank pin, with or without a hook or friction wheel or bush upon it, and at the same time to allow the pin with or without a bowl freedom of action in the slot. As the crank is turned round, the rod will advance and recede laterally without partaking of the rotary action or the rise and fall of the crank pin, this being rendered neutral by the pin traversing the aforesaid slot, and allowing the rod to move at any required angle to the line of the knife-bar, the rear bush of the connecting rod meanwhile occupying a position on either side of the slot. The inventor also employs an improved method of attaching the finger beam of reaping and mowing machines to the main frame by means of a hinged bar having its rear end secured to the frame by a flexible joint, and its front end connected to the finger beam by a similar contrivance, and by the combined action of the two joints the finger beam will accommodate itself to the irregularities of the ground as the machine advances to its work. Connected to, or formed upon, the aforesaid hinged bar, is a suitable fixing or joint, for the purpose of connecting it with a back stay, which is carried to the rear end of the main frame, and terminates in a joint which secures freedom of movement without confining the stay to any given line of action. The said joint is properly secured to the main frame, so that the stay will allow the finger beam to adjust itself to the irregularities of the ground, and at the same time retain the bar and finger beam at any required angle more or less from a right angle to the line of draught of the machine. The inventor also employs an improved mode of driving the knife crank spindle of reaping and mowing machines by means of worm wheel gear. *Patent abandoned.*

811. J. LEEMING and R. S. MARKINDALE. *An improvement in carding engines.* Dated March 28, 1863.

This invention relates to the class of machines known as carding engines, or machines employed in the preparation of fibrous materials for spinning, and for other purposes. In machines of this description there are sometimes employed in each machine two or more carding cylinders or swifts, the fibrous material in process of preparation in the machine being transferred from one carding cylinder or swift to another carding cylinder or swift by a doffer or doffing cylinder, one doffer or doffing cylinder only having hitherto been employed between any two carding cylinders or swifts. These improvements consist in employing in machines of the above description two or more doffers or doffing cylinders between any two carding cylinders or swifts for transferring the fibrous material from one carding cylinder or swift to another carding cylinder or swift, by which means the patentees are enabled to prepare with each machine a larger quantity of fibrous material in a given time than where one doffer or doffing cylinder only is employed, and also to improve the quality of the sliver and maintain the machine in a clearer and better working condition. *Patent completed.*

812. A. BLOUIN and D. N. MERCIER. *An improved axletree with linked levers for lifting.* Dated March 28, 1863.

This machine is composed—1, of a triangular framing with horizontal extension, the two sides of which are tied by bolts, other bolts serving to fix the frame to the ground; 2, of a large toothed wheel; 3, of three levers linked or jointed on the same axle; 4, of two eccentrics, to which are attached the arms of two of the levers; 5, of two toothed wheels on the same axle as the eccentrics. The axle of the said eccentrics and toothed gearing rests on a cast-iron piece or chair which forms a bearing between the eccentrics and the toothed wheels. This chair is attached to the framing resting against its extension. The axles of the above-mentioned eccentrics and toothed gearing have the shape of a crank; they are tied at their end by a bolt which passes at the same time in the slide of the third lever; 6 and last, of two other toothed wheels fixed on another shaft which receives a crank. The toothed wheel has three rows of teeth and a collar which may receive a break. It is on the axle of this wheel that the rope or chain attached

to the burden or load will roll. The teeth are arranged regularly, but so that those of each row alternate and receive the action of the levers one after the other. The levers have a slide which permits them to slide on a friction roller which unites them, some to the eccentrics, the other to the crank shafts which carry these same eccentrics. The same circular movement, therefore, sets the three levers in motion, and causes them to execute an alternate rise and fall. The head of the levers is traversed by the same axle; it is set to balance on one side only for the passage of the teeth, but a spiral spring bears it back immediately to its place. On turning the crank the two toothed wheels on its axle give motion to the two others, which are on the same axle as the eccentrics, and these as well as the said axle which forms the crank shaft set in motion the levers, which each rise and fall once during a turn or revolution of the eccentrics, and it is in this movement that the levers take by turns into the teeth of the wheel, and give it the rotary motion which is to lift the load. *Patent abandoned.*

813. W. SYMONDS. *Improvements in barometers.* Dated March 28, 1863.

The objects of this invention are to produce standard and other barometers in which the mercury is contained in a syphon tube, in which the reading takes place at one point and in which the mercury is stopped and the barometer rendered portable. *Patent completed.*

814. G. THOMAS. *Improvements in window shutters and window blinds.* Dated March 28, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

815. J. DALE and G. BISCHOF, jun. *Improvements in the manufacture of aniline, napthylamine, and other analogous bodies, and in apparatus connected therewith, which apparatus is also applicable to obtaining finely divided metallic iron for other purposes.* Dated March 28, 1863.

In the manufacture of aniline and analogous bodies there is a large quantity of metallic iron used, which is obtained chiefly from borings or turnings subsequently ground, so as to bring them into small particles. Now the first part of this invention consists in a method of producing metallic iron in a finely divided state. This is effected by submitting an oxide of the metal to such a heat as will effect its reduction, but will not fuse the metal. This process may be effected in a retort or other ordinary apparatus, but the patentees propose using a certain arrangement of furnace which is also applicable for obtaining the metal in the above-named condition for other purposes. The arrangement which they propose consists in placing the fire bars at one end of the furnace, and the flue at the opposite end, the working door being at the latter. In connection with the bed of the furnace there is an air-tight chamber, into which the reduced metal may be raked. This furnace may be provided with a charging door at the side to be closed air-tight during the operation. In reference to the manufacture of aniline, or other analogous body, the process may commence with the usual description of iron, and after it has become oxide, it may be reconverted into the metallic state for subsequent use as above described. For the purposes of producing finely divided iron applicable to the manufacture of aniline, they take an oxide of the metal, and, having ground it, mix therewith from 20 to 25 per cent. of small coal, or other carbonaceous matter. The mixture is then submitted to heat in any suitable apparatus (an ordinary retort for instance) until reduction of the metal is effected, care being taken to keep it below that temperature which would cause fusion. A red heat is the degree required, and the process will be completed in from eight to twelve hours. The finely divided metal thus obtained is liable in its heated state to become again oxidized if exposed to the air, and it is therefore desirable to adapt a vessel to the mouth of the retort into which the metal may be raked, and which may subsequently be closed up until the metal is cold. The finely divided iron thus obtained they use for the manufacture of aniline and analogous bodies in the same manner that iron is now used for that purpose. On commencing the manufacture of aniline or analogous body the usual turnings or borings of iron may be employed. These during the process become oxidized, and are therefore in the proper condition for being converted into the finely divided metal as above described. *Patent completed.*

816. J. MUSGRAVE. *Improvements in the construction of steam boilers.* Dated March 30, 1863.

This invention is applicable to steam boilers having two longitudinal flues containing at one end the fire-grates. These flues extend from one end of the boiler to the other, and impart the requisite strength to the ends, but they are closed near the bridge at the firing end, either by partitions of fire-brick, or otherwise. The products of combustion descend through vertical flues into an external horizontal flue; they then pass along external flues to the end of the boiler, where they enter the end of the internal flues, from whence they descend through vertical flues into an external flue, which is in communication with the chimney. *Patent completed.*

817. T. BARNES. *Improvements in treating fats and fatty oils, and volatile oils or essential oils.* Dated March 30, 1863.

This invention consists in a new and novel mode of decolouring, deodorizing, and indurating fats, oils, and oleaginous bodies, by the use of sulphuric acid gas and carbonic acid gas, in combination with atmospheric air, or alone, so as to deodorize and indurate the same. *Patent abandoned.*

818. R. MUSHET. *An improvement or improvements in moulds to be used for casting steel or homogeneous iron.* Dated March 30, 1863.

This invention consists in making moulds to be used for casting steel or homogeneous iron either wholly or mainly of sheet iron. *Patent completed.*

819. H. HUGHES. *Improvements in machinery for shaping metal and plastic substances.* Dated March 30, 1863.

This invention consists in shaping metal and plastic substances by means of a set of two, three, or more rolls, cut or formed with the shape or pattern to be produced, in a spiral direction from end to end of the rolls. The rolls are driven at the same speed, and in the same direction, and the metal or plastic material is presented to the rolls in a line parallel to the axis thereof, or nearly so, and by the rotation of the rolls is carried through between them in a direction at right angles, or nearly so, to that of their rotation. The patentee employs guides to keep the articles in their proper position while passing through the rolls. *Patent completed.*

820. J. CARVER. *Improvements in the manufacture of carriages employed in machines for the making of lace or other fabrics.* Dated March 30, 1863.

Heretofore, in carriages employed in machines for the manufacture of lace or other fabrics the springs which hold the bobbins in place have been fixed at the side of the carriages at about the centre of the bobbins, which arrangement has necessitated the use of springs of considerable length, thus rendering the bobbins liable to lean or project over the side of the carriages, so that the warp threads become likely to enter the bobbins, and so occasion injury to the lace or fabric and loss of time; and, moreover, in the said arrangement as heretofore used, a space being necessarily left in the carriage between the bobbin and the root of the spring, knots, burrs, or other unevenness of the thread or material wound on the bobbin become liable to drag or impede its revolution, and thereby cause instantaneous fracture of such thread or material, so as to render it inexpedient to wind the bobbins full of thread, or even nearly so, in consequence of the thread dragging at the before-mentioned space. The object of this invention is to remedy these defects; and for this purpose the patentee fills up the aforesaid open space by using in a carriage of any given size a larger bobbin than than has heretofore been used in a carriage of such size, and he places the spring at the top part of the carriage, or nearly so, instead of at the side thereof, as heretofore, so that when the top of the carriages are pressed by the warp threads, the springs will keep the bobbins perfectly upright in the carriages, and thus prevent the warp threads from entering the bobbins. The space between the carriage and the bobbin being thus filled up, the size of the carriage can be reduced, and "more lead" (as it is called) can be given to the carriage. The improved arrangement also allows of the employment in a carriage (of any required size) of a larger bobbin than has heretofore been used (in a carriage of such size); and as upon such larger bobbin a larger quantity of thread or material can be wound than on a smaller bobbin, pieces of lace or fabric can be produced of greater length than could have hitherto been produced with bobbins in carriages of the same dimensions under the old arrangement. *Patent completed.*

821. W. E. NEWTON. *An improved process for producing yellow colouring matters and other colours which may be derived therefrom.* (A communication.) Dated March 30, 1863.

This invention consists in a novel process for obtaining from napthaline a yellow dye, which may be used either alone for dyeing yarns or threads and piece goods, or be treated with suitable chemical reagents for varying its hue, as desired. The following is the mode of carrying out the improved process:—The patentee takes 100 kilogrammes of napthaline, and boils the same for a few hours in an acid solution composed of 200 kilogrammes of water and 20 kilogrammes of nitric acid at 30 degs. Beaumé. The napthaline must be kept well stirred while dissolving in the boiling water and acid, and the agitation must be maintained until the mixture has become cold. He next draws off the mother liquor, and the napthaline will then present the appearance of brown crystals. These crystals are now to be well washed in cold water to remove the acid. In order to obtain a yellow solution of colouring matter, the crystalline product is to be treated with boiling water, to which is added 5 kilogrammes of liquid ammonia. The solution thus obtained is to be filtered, and subsequently evaporated into a concentrated state. The concentrated solution must in like manner be filtered, and when cold it will be ready for use. *Patent completed.*

822. W. AGER. *Improvements in machinery or apparatus for cleaning and decorticating grain.* Dated March 30, 1863.

According to this invention, it is proposed to employ a modification of the well known barley mill, but to adopt an arrangement whereby a current or currents of air may be directed through the rice or other grain during the operation of cleaning the grain and removing the inner pellicle. For the better action of the currents of air upon the rice or other grain a number of ledges or projections are fitted longitudinally to the interior of the revolving screen or outer casing, which ledges serve to carry up the grain, and allow it to descend again to the bottom of the casing, the current or currents of air being directed through the falling grain, and carrying off the dust or flour produced by the action of the decorticating stones, thus leaving the rice or other grain perfectly clean and free from the inner pellicle. *Patent abandoned.*

823. J. PAYNE. *Improvements in fire-escapes.* Dated March 30, 1863.

Under one modification, the improved fire-escape consists of a simple open rectangular framework to be placed inside the window of the house. This frame may be constructed so as to have the appearance of a piece of furniture —a settee or ottoman, for instance. On this frame is disposed, in end bearings, a horizontal chain or rope barrel, cylinder, or winding drum, the spindle of which is fitted with ratchet gearing and pawls. Attached to and wound upon or over this cylinder or barrel is a chain or rope ladder, the loose free end of which is fitted with a transverse or cross bar having a hook or clipping holding piece at each end for attachment to any suitable fixture in the street or road outside the house. In this way, or by these means, whenever a fire occurs, the chain or rope ladder can be wound off the cylinder or barrel from within, and the ladder can thus be let down from the window so as to reach the ground outside the house. *Patent abandoned.*

824. E. T. HUGHES. *An improved composition for rendering, cloth, paper, and similar articles transparent and waterproof.* (A communication.) Dated March 31, 1863.

This composition is composed of one part by measure of linseed oil, one part by measure of india-rubber cement, and six parts by measure of benzine. This, for most purposes, constitutes probably the best mixture; but for a preparation of tracing cloth and tracing paper of close texture it may be advisable to use an additional proportion of benzine, to avoid producing a gloss on the outside, and also to avoid filling the pores of the paper too full to retain the ink and colours which may be applied. *Patent completed.*

825. J. SMETHURST. *Improvements in steam engines and boilers, part of which improvements is applicable to heating purposes.* Dated March 31, 1863.

In carrying out this invention, the patentee employs a compound boiler, consisting of an inner and outer shell, and as he proposes having a much greater pressure in the inner shell than will be in the outer, the steam from the former is intended to supply a high-pressure engine, the exhaust steam from which will pass through pipes to another high-pressure cylinder of larger size, or to a condenser, or directly into the outer shell of the compound boiler, and will thus pass with the steam generated in the said outer shell (unless discharged into a large cylinder or into a condenser) to another high-pressure cylinder, from which the exhaust steam will pass through pipes to a low-pressure condensing steam engine, or into a condenser, or through a series of pipes so arranged in the various rooms of a building as to be serviceable for heating and other purposes, as also for surface condensation. *Patent completed.*

826. A. B. D. MAURAND. *A translucid, cylindric apparatus for bringing the former weights and measures into those of the present decimal system most easily and precisely, and vice versa.* Dated March 31, 1863.

This invention is not described apart from the drawings. *Patent completed.*

827. R. FURNIVAL. *Improvements in and applicable to plaiting or braiding machines.* Dated March 31, 1863.

This invention consists—1, in the use of arrangements accomplishing the objects above described by alternately and at regular intervals arresting the motion of the threads from each other at a point between the focas and the bobbins, and then releasing them; and the improvements may be carried out by various means—namely, by a circle or surface carrying teeth which can pass through all (or a part only if required) the spaces between the threads at the same time, this toothed circle or surface being arranged on a vertical rod, which has an up-and-down motion imparted to it by a cam, so that when elevated its teeth pass between and interrupt the motion of the threads, and when lowered the teeth are withdrawn from the threads, which are thus released and allowed to assume their natural position when unobstructed. The invention consists—2, in introducing pushers between the threads all round the focas, so as to enter between them and push the plaits or twist towards the focas; and this action may be combined with that described in the first part of the invention, by making the teeth inclined on the upper edge, the incline being upwards from the inner circumference to the outer circumference, so that the outer point of the teeth will first pass between the threads, and as the surface carrying the teeth is lifted, the incline of the teeth will drive the plaits forward towards the focas. *Patent abandoned.*

828. W. FORREST and H. DUCKWORTH. *Improvements in looms for weaving.* Dated March 31, 1863.

This invention relates—1, to the traverse of the slay or lathe. The improvements consist in arranging the bearings which carry the ends of the crank arms working the sword arms or lathe or slay in such a manner as that their positions may be altered by raising or lowering them at pleasure, by which means the inventors are enabled to regulate the traverse of the lathe or slay in order to accommodate the loom to different kinds of goods and qualities of yarn. The second part of the invention relates to the "wing," which, in looms as heretofore constructed, requires lifting over the "frog" at each and every pick, except in case of concussion, or when from any cause the shuttle does not shed properly. The object is to dispense with the usual lifting of the wing, by which means the inventors are enabled to run a fast reed loom as quick or pick as often as with a loose reed loom. *Patent abandoned.*

829. A. H. and V. G. BELL. *An improved mode of constructing the armour of vessels of war.* Dated March 31, 1863.

In carrying out this invention, the inventors form the shot-proof covering of alternate lines of iron and wood, the interposed lines of timber being sufficiently narrow to ensure the adjacent iron bars intercepting any heavy shot that may strike the wood. The lines of iron are divided into bars of a convenient length. These bars are furnished at the back with projections welded on to them, which in pairs form jaws of a dovetailed shape at equal distances apart. Vertical ribs of the form hereafter described are let into the timber backing between the skin of the vessel and the armour, so that their exterior surfaces shall be flush with the front of the backing at intervals corresponding with the jaws on the armour bars. These ribs carry alternately on their face throughout their length a dovetailed form in cross section, corresponding in length with the depth of the iron bars, and for a length equal to the space between the iron bars a flange with parallel faces. The dove-tailed projections fit into the jaws of the armour bars, and the spaces between these projections allow of the jaws on the armour bars passing freely on and off the vertical ribs. The vertical ribs being fixed in their places and secured to the framework of the vessel by bolts, the armour bars are inserted in the spaces left for that purpose in the verticals, and lowered down until the jaws clip the dovetailed portions of the ribs, the intermediate timbers being built up alternately with the iron bars. Keys which clip the vertical ribs are driven in between the lines of bars, securing them firmly in their positions. The armour bars are arranged so as to break joint one above the other, by which means the armour becomes a self-supporting structure round the vessel. *Patent abandoned.*

830. R. A. BROOMAN. *Improvements in electric telegraph printing apparatus.* (A communication.) Dated March 31, 1863.

This invention is not described apart from the drawings. *Patent completed.*

831. E. O. COE. *Improvements in propellers for ships and other vessels.* Dated March 31, 1863.

This invention consists of one or more corrugated wheel or wheels made of metal, wood, or wood and metal combined, or of any other convenient substance. The corrugations radiate from the centre to the circumference, and the wheels may be wholly of solid metal, or may be of solid metal only to a certain depth from the periphery, having the more central part open or perforated. They are to be revolved by connection with machinery worked by any motive power, and may be applied at the sides of vessels as paddle wheels now are, or at the stem or stern, or both, or in any other convenient position. *Patent abandoned.*

832. H. HAMER. *Improvements in tanning, and in apparatus employed therein.* Dated March 31, 1863.

According to this invention, the hides or skins are suspended within an air-tight vessel, so that the tanning liquor which the vessel contains may come in contact with every part of each hide or skin. The patentee exhausts the air from the tank, and, further, keeps the tanning liquor in motion during the process, so as to prevent it separating, and so that it may sweep off from the hides or skins the film of spent liquor immediately it is formed. The apparatus employed for this purpose is a rectangular tank capable of being closed air-tight by a lid. Within this tank is a frame, somewhat shorter than the tank, and capable of moving to and fro endwise within it, this motion being given to it by a rod which is attached to the frame; the rod passes out through a stuffing box in the end of the tank, and is then connected with an eccentric or other similar instrument. The frame runs backwards and forwards within the tank on suitable guide rails, and the hides or skins are hung on laths at the upper part of the frame transversely of the length of the tank. As the hides or skins move to and fro, the tanning liquor presses first on one side of them and then on the other. The tank is connected with an air-pump, and is exhausted during the process. *Patent completed.*

833. J. M. DUNLOP. *Improvements in machinery for spinning cotton.* Dated March 31, 1863.

To that class of machinery known as Macarthy's gin, the patentee applies a cylinder or shaft with pegs or agitators placed near the point of contact of the gin roller and the knife or "doctor" on the feeding side of the gin, or it may be a cylinder with a vane or vanes set spirally or inclined to the axis. The shaft or cylinder above mentioned is carried in brackets or bearings secured to the framing of the gin, and may be used with or wihout a grated rack (hereafter referred to); or the shaft or cylinder may be carried by the ends of the grated racks described in the specification of a former patent (No. 1922), dated July 1, 1862, and in the latter case would move up and down with the grated rack. He, however, prefers the former. The shaft or cylinder above described is to have a suitable revolving motion given to it; or it may have one or more revolutions first in one direction and then in the other; or it may have an intermitent motion; or it may have a lateral motion. The object of these arrangements is to keep presenting the seed cotton to the action of the roller and knife that it may be more readily engaged thereby, and the seed separated from the cotton. The shaft or cylinder, in place of being provided with the same pegs or agitators as above described, may be a roller, either fluted, toothed, or covered, so that it will move the seed cotton and keep it in constant movement at the feeding part of the machine. The improvements may also be applied to the Roller Churka gin. One or both of the rails, described in the specification of the patent above referred to, and which carry the "doctors," in place of being applied as therein described, is or are made to swivel on pivots which fit into holes bored or formed in the frames. These rails with the "doctors" attached to them, when so made to swivel, are kept in their proper working position relatively with the curved rollers of the gin by set screws screwed into snugs cast with or formed on the framing, and they are thus caused to give the necessary pressure against the covered rollers. The top of the wood connecting rods and the moveable knife described in the specification of the aforesaid former patent, in place of being arranged and connected as therein described, have shoes applied, into which the wood connecting rods are fitted. These shoes are bolted to the moveable knife, and have projections downwards to admit of their being well secured to the wood connecting rods. A cross bar or projection is cast across each of the shoes, and a corresponding notch is cut out of each of the wood connecting rods, so that the strain does not entirely depend upon the bolts. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 23, 1863.

1576. A. R. Stocker, Wolverhampton, manufacturer. Improvements in preparing and fashioning iron applicable to the manufacture of boot heels, tips, and horse shoes, and in part of the machinery or apparatus to be employed therein.

Dated July 28, 1863.

1871. A. Hector, Montrose, gentleman. Improvements in means or apparatus for facilitating the catching of fish.

Dated September 2, 1863.

2165. M. Pinner, 12, South-terrace, Grosvenor-park, Camberwell. The manufacture of a flexible translucent material or fabric to be used as a partial substitute for glass. (A communication.)

Dated September 8, 1863.

2207. J. Burch, Cragg Works, near Macclesfield, engineer and manufacturer. Improvements in printing on curtain and other terry and velvet pile carpets, felted cloths, and other fabrics and materials, and in the processes and apparatus connected therewith.

Dated September 19, 1863.

2308. J. Fraser, 12, South-terrace, Grosvenor-park, Camberwell. An improved method of constructing magazines for the safer and more economical storing of volatile oils in localities where the ground and labour are expensive. (A communication.)

Dated September 24, 1863.

2360. H. A. Bonneville, 38, Porchester-terrace, Bayswater. Improvements in horse collars. (A communication.)

2361. H. A. Bonneville, 38, Porchester-terrace, Bayswater. Improvements in joining leather. (A communication.)

Dated September 26, 1863.

2375. E. B. Wilson, 5, Parliament-street, Westminster, civil engineer. Improvements in furnaces and fireplaces, applicable to the heating of steam boilers and other purposes.

Dated September 30, 1863.

2396. E. S. Attree, 37, Gibson-street, Waterloo-road, Lambeth. An improved cigar-holder. (A communication.)

Dated October 1, 1863.

2400. W. Smith, 4, South-street, Finsbury, London, civil engineer. An improved process for re-crystallizing sugar.

2402. T. Bell, Wishaw, Lanark, manager. A new mode of manufacturing bricks and tiles.

2403. H. A. Bonneville, 38, Porchester-terrace, Bayswater. Improvements in railway and other breaks. (A communication.)

2404. L. N. le Gras, Rathbone-place, Oxford-street, civil engineer. Improvements in cooking stoves and apparatus.

2406. J. Bell, Linton, Cambridge, civil engineer. Improvements in couplings for railway carriages.

2408. G. Dickey, Southwark, cabinet maker. Improvements in winkers or eye-screening apparatus for horses and other animals.

2410. T. Horsley, York. Improvements in breech-loading firearms.

Dated October 2, 1863.

2412. J. Farrar, Halifax, Yorkshire, machinist. Improvements in machinery or apparatus for spinning and doubling wool, alpaca, mohair, cotton, silk, flax, and other fibrous substances.

2416. J. G. Tongue, 34, Southampton-buildings, Holborn, engineer. An improved compound reactive agent and universal mordant to be employed in the processes of dyeing and printing. (A communication.)

2418. J. J. Lundy, Leith, colour and chemical manufacturer, and R. Irvine, Magdalen Chemical Works, Musselburgh, manufacturing chemist. Improvements in the manufacture of paper.

2420. G. T. Bousfield, Loughborough-park, Brixton. Improvements in revolver firearms. (A communication.)

2422. J. Bowron, South Stockton, Yorkshire, glass manufacturer, and G. Robinson, Welbeck-street, Cavendish-square. Improvements in the manufacture of soda.

Dated October 3, 1863.

2424. G. R. Tilling, Birkenhead, millwright, and J. Park, Liverpool, die and seal engraver. An improved mode or method of filling tobacco-pipes of an improved construction.

2426. T. and J. Fagg, Panton-street, boot makers. Improvements in the manufacture of boots and shoes.

Dated October 5, 1863.

2430. C. Brakell, W. Hochl, and W. Günther, North Moor Foundry Company, Oldham. Improvements in motive engines worked by water, steam, or other motive power. (Partly a communication.)

2432. O. Tomlinson, Grove Vale Cottage, Great Barr, Stafford, accountant. Improvements in taps, cocks, hydrants, or valves, and apparatus connected therewith, for opening, closing, regulating and facilitating and otherwise controlling the passage or flow of water, air, steam, gas, and other fluids and liquids.

2434. W. H. Bayley, Keighley, Yorkshire, mechanic. Improvements in machinery for combing wool and other materials. (Partly a communication.)

2438. J. Towlson, Heigham, Norwich, engineer. Improvements in apparatus for cooling liquids.

2440. W. Legg, Liverpool, hat and cap manufacturer. Improvements applicable to sewing machines.

Dated October 6, 1863.

2442. E. Whitehouse, Wolverhampton, manufacturer. Certain improvements in the manufacture of wrought-iron shackles.

2446. G. Dyer, Regent-street. Improvements in the construction of railway carriages.

Dated October 7, 1863.

2450. E. Leak, Longton, Staffordshire. Improved apparatus to be used in placing "glost" china and earthenware in ovens and kilns for firing, burning, or baking such ware.

2452. G. F. Graham, 1, Upper Gordon-street, Euston-square, surveyor and builder. Improvements in high pressure cocks.

2454. C. P. Button, 27, Leadenhall-street, merchant. Improvements in pumps. (A communication.)

2456. R. Zox, Nelson-square, Blackfriars-road, hat and cap manufacturer. Improvements in the manufacture of academic caps.

2458. E. Slaughter, Avonside Iron Works, Bristol, engineer. Improvements in locomotive engines.

2460. G. Whight, Ipswich, machinist. Improvements in washing apparatus. (A communication.)

Dated October 8, 1863.

2462. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in propelling ships and in the apparatus employed therein. (A communication.)

2464. C. Crosswell, 8, Salisbury-street, Strand. Improvements in breech-loading firearms. (A communication.)

2465. M. Smith, Bushfield-house, Donnybrook-road, Dublin. Improvements in washing, cleansing, salting, and packing butter, and in apparatus to be employed therein.

2466. G. Canouil, Paris, chemist, and F. A. Blanchon, Paris, manufacturer of toy arms. Shooting toy fusees, toy rockets, or other similar toy missiles, by means of toy pistols or other toy firearms.

2468. J. D. Dougall, 59, St. James's-street, Westminster. Improvements in "camel guns" and other light artillery, which improvements are also applicable to "punt guns" or other heavy fowling pieces or rifles.

2472. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in the construction of condensers. (A communication.)

Dated October 9, 1863.

2474. J. Wood, J. Whitehead, and T. Tetlow, Oldham, engineers. Certain improvements in machinery or apparatus for governing the speed of steam engines.

2475. J. Elsom, 10 and 11, Regent's-row, Dalston. Improvements in parallel turning, and in machinery for that purpose.

2476. E. W. James, Brynllys, Cardigan, farmer. Improved apparatus and arrangements for giving buoyancy to or raising sinking or submerged ships and other sinking or sunken bodies.

2478. J. McInnes, Liverpool, manufacturer of compositions for protecting the bottoms of iron ships. Improvements in sheathing for navigable vessels of iron or wood, which sheathing is also applicable to the covering of roofs, walls, and other purposes.

2481. N. Fellows, 123, Chancery-lane. An improved mode of extinguishing fires in chimneys and flues, regulating and promoting draught therein, calculated also to act as a ventilator.

Dated October 10, 1863.

2484. G. W. Reynolds, Smethwick, Staffordshire, crinoline manufacturer. An improved manufacture of bands or strips for crinolines.

2488. W. B. Fairbanks, J. Lavender, and F. Lavender, saddlers, ironmongers, bridle cutters, harness makers, &c., Walsall, Staffordshire. Improvements in the manufacture of hames.

Dated October 12, 1863.

2492. A. Inglis, 53, Arthur-road, Holloway. Improvements in taps or cocks, part of which improvements is applicable to the lubrication and protection of the journals of revolving shafts, axles, or spindles.

2494. W. Hutchison, 21, Cardigan-street, London. Improvements in the manufacture of fittings for powder flasks.

2498. T. Browning, Liverpool. Improvements applicable to metallic casks, and the machinery for the manufacture of the same.

2500. T. Fox, Ballingdon, near Sudbury. Improved apparatus for cleaning out the tubes of steam boilers, which apparatus is also applicable for cleaning out other tubes.

Dated October 13, 1863.

2506. J. Dodge, Waterford, New York, mechanical engineer. Improvements in machinery for rolling, shaping, or forging metals, and in apparatus for grinding and polishing the same.

2508. J. E. Poynter, Glasgow, chemical manufacturer. Improvements in throwing stone projectiles by means of explosive agents, and in apparatus therefor.

2509. J. Place, Hoddlesden, Lancashire, coal proprietor. Improved application of certain schistous or shaly materials to the manufacture and finishing of paper.

2510. A. Rolfe, Amwell-street, Pentonville, merchant. Improvements in means or apparatus for propelling carriages on railways, tramways, or on common roads.

2512. T. Scott, 31, Nelson-square, Blackfriars-road, engineer. Improvements in floating docks.

Dated October 14, 1863.

2516. J. Inchley, Birmingham, manufacturer. Improvements in valves for double cylinder steam engines.

2518. M. F. D. Cavalerie, 10, Rue de la Fidelité, Paris, mechanical engineer. Certain improvements in obtaining centrifugal motive power.

2520. W. J. Rideout, Farnworth Mills, Bolton, Lancashire, paper manufacturer. Improvements in boiling rags and other paper-making materials.

Dated October 15, 1863.

2525. P. Lesley, Philadelphia. Improvements in the manufacture of rails for railways. (A communication.)

2527. S. R. Smith, 7, Delamere-street, Paddington. Improvements in apparatus for connecting chain cables, and for clearing a ship's hawse when foul, and also in apparatus for acting on and preventing strain to the chain cables when ships are riding at anchor.

2529. B. F. Weatherdon, Kingston-on-Thames. A new apparatus for rubbing off or removing the dust or dirt from boots or shoes.

Dated October 16, 1863.

2531. J. Polglase, Bodmin, Cornwall, mine agent, and J. Cox, Manchester, agent. Improved apparatus for boring and cleaving stone.

2533. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in pumps to be worked by steam. (A communication.)

2534. F. A. E. G. de Massas, Hoxton, civil engineer. Improvements in smut machines, and in machines for cleansing and peeling grain and seeds.

2536. S. Jay, Regent-street. Improvements in the manufacture of stockings and drawers.

Dated October 17, 1863.

2537. M. Meisel, Park-walk, Brompton. Improvements in apparatus for ascertaining the weight of the load supported by the springs of railway locomotives and carriages for the purpose of regulating or equalizing such load. (A communication.)

2539. J. Shanks, Barrhead and Greenock, plumber. Improvements relating to water closet and other valves or taps.

2540. W. Hampson, jun., Dukinfield, Cheshire, overlooker. Certain improvements in looms for weaving.

2541. W. Routledge and F. F. Ommaney, Newbridge Foundry, Salford, engineers. Certain improvements in "baling boxes" used in packing cotton or other fibrous materials.

2542. W. Clark, 53, Chancery-lane, engineer. Improvements in rotary engines. (A communication.)

2544. W. Clark, 53, Chancery-lane, engineer. Improvements in sewing and embroidering machines. (A communication.)

2545. L. B. Chesbrough, Brooklyn, New York. An improved let-off motion for looms. (A communication.)

2547. W. Darlow, North Woolwich-road, and R. H. Lawson, Victoria-terrace, Victoria-docks. Improvements in apparatus or means for obtaining motive power.

2548. J. Wright, Esplanade, Rochester. Improvements in machinery for cutting railway sleepers to receive railway chairs.

2550. F. de Wylde, Trinity-square, Tower-hill. Improvements in the induration of stone, cement, stucco, brick, or other analogous materials, also in the manufacture of artificial stone.

2551. F. de Wylde, Trinity-square, Tower-hill. Improvements in the separation of molasses and other impurities from sugar crystals. (A communication.)

Dated October 19, 1863.

2552. J. Champion, Manchester, machinist. Improvements in machinery or apparatus for preparing, spinning, and doubling cotton, flax, wool, and other fibrous materials.

2553. W. Clark, 53, Chancery-lane, engineer. Improvements in separating ores from their gangues, and in apparatus for the same. (A communication.)

Dated October 20, 1863.

2559. J. Taylor, engineer, and J. and J. Lees, tin plate workers, Oldham. Improvements in machinery or apparatus for opening, cleaning, and mixing cotton or other fibrous materials.

2560. E. H. Luebbers, Liverpool, merchant. An improved treatment of textile substances to obtain a species of, or substitute for, cotton. (A communication.)

2561. W. Ingham, Manchester, and I. Wood, Pendleton, near Manchester. Improvements in the manufacture of copper rollers used for printing calico or other materials.

2563. D. Mills, Birmingham, manufacturer. An improvement or improvements in the manufacture of moulds for casting studs for chains.

2564. J. Vaughan, Birmingham, manufacturer. Improvements in the manufacture of picks, hoes, adzes, and other edge tools, and in tools to be used in the said manufacture.

2565. J. Michaelis, 3, Tower Royal, Cannon-street West, and 35, Aldersgate-street. Improvements in the manufacture of purses, pocket-books, and wallets, and in the construction of double-action locks for the same and other similar purposes.

2569. J. Bryant, Edgware-road, engineer. Improvements in vent apparatus for facilitating the drawing off or letting off fluids.

2570. H. B. Barlow, Manchester. Improvements in shoes, boots, and other coverings for the feet. (A communication.)

2571. W. A. Dixon, Glasgow, chemist. Improvements in making aluminate of soda and other aluminous salts.

2572. G. Davies, 1, Serle-street, Lincoln's-inn, civil engineer. Improvements in forming stitches over the edges of fabrics, and in machinery connected therewith. (A communication.)

2573. J. W. Nottingham, Clayton-place, Kennington-road, artist. Improvements in "Hansom cabs," parts of which improvements are also applicable to other wheeled carriages.

2574. G. H. Daglish and T. Windus, St. Helen's, Lancashire, engineers. Improvements in machinery for bending plates for iron ships and other like purposes.

2575. C. Garton, Bristol, brewer, and T. Hill, Southampton, sugar refiner. Improvements in evaporating, cooling, and melting, and in apparatus employed therein.

2577. T. Restell, Water-lane, Tower-street, London, engineer. An improved construction of walking-stick umbrella.

Dated October 21, 1863.

2578. W. Hartcliffe, Salford, machinist. Certain improvements in mules for spinning and doubling.

2580. J. Hinton, Birmingham, gun action filer. An improvement or improvements in breech-loading firearms.

2582. N. F. Taylor, 5, Manby-street, Stratford, gas engineer. Improvements in increasing the illuminating power of coal gas, and in the means or apparatus employed therein.

2583. G. Howell, Hawarden Iron Works, near Holywell, Flint. Improvements in apparatus for condensing metallic and other fumes.

2586. Z. Colburn, 3, Upper Bedford-place, Russell-square. Improvments in steam engines.

2590. J. Dodd, Oldham, machinist. Improvements in mules for spinning and doubling.

2591. W. E. Newton, 66, Chancery-lane, civil engineer. An improvement in sewing machines. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, November 3, 1863.

1550. C. Peterson. Manufacture of pipes or tubes.

1562. E. Wilks. Portmanteaus and trunks.

1576. A. R. Stocker. Preparing and fashioning iron.

1580. T. F. Parsons. Preparing plates, bars, or other objects of iron.

1590. T. Redwood. Straining or mixing and straining liquid and solid substances.

1591. P. R. Hodge. Improved fleeting hydrostatic machinery.

1592. E. Myers and W. R. Williams. Wet gas meters.

1595. T. Skinner. Ornamentation of silver, German silver, Britannia metal, electro-plated or other plated goods.

1596. A. E. Brae. Actuating domestic bells and other ...als by the electric current.

... T. Page. Horse shoes and fastenings.

... H. C. Lee. Sewing machines. (A communication.)

... Watson. Fastening.

1611. W. E. Gedge. Placing tyres on wheels or hooping or ferruling generally, while the metal is hot. (A communication.)

1612. J. Griffiths. Puddling iron and steel.

1614. T. Dunn. Construction and maintenance of the permanent way of railways.

1615. G. Clark. Construction of guns and projectiles.

1621. C. Avery. Rotary engines.

1622. L. E. Hicks. Inkstands.

1639. J. H. Johnson. Coating or covering metal sheets. (A communication.)

1644. J. and J. Cole. Looms for weaving.

1651. J. King. Hanging gates.

1657. H. Brinsmead. Cooking apparatus.

1659. H. S. Warner. Treating or preparing megass and other substances to be used as fuel.

1666. H. A. Bonneville. Steam engines.

1709. R. A. Brooman. Ships and propelling the same. (A communication.)

1734. M. W. Ruthven. Rudders or apparatus for steering ships.

1789. B. Lambert. Preparation of waste paper in order to its being again used.

1822. W. Clarke. Manufacture of fabrics.

1916. H. Woods. Regulating the temperatures during the process of fermentation in the "union cask," "tunning cask," or "cleansing cask."

2007. A. E. Brae. Conducting electric currents through railway trains, and actuating signals or alarums therein.

2092. A. Jobson. Drawing or discharging coke ovens and loading coke waggons.

2245. M. Gerstenhöfer. Roasting pyrites.

2447. A. Johnston. Railway carriages.

2464. C. Croswell. Breech-loading firearms. (A communication.)

2472. A. V. Newton. Construction of condensers. (A communication.)

2477. G. Parry. Refining crude pig iron.

2525. P. Lesley. Manufacture of rails for railways. (A communication.)

2540. W. Hampson. Looms for weaving.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed November 2, 1863.

1053. F. Bennett.
1110. J. Fortune.
1112. B. G. Sloper.
1116. W. Walsh.
1122. P. Bradshaw.
1124. W. Glover.
1127. T. Sagar and J. Wilkinson.
1130. S. Hibbert, J. Lawton, and J. Kay.
1131. S. D. MacKellen.
1132. I. M. Singer.
1135. A. Sturrock.
1138. J. Park.
1143. G. Bower.
1145. J. Bettridge.
1146. C. A. Day, A. Lamb, and T. Summers.
1149. P. J. Livsey.
1151. H. Schooling.
1153. C. L. Braithwaite and J. Hirst.
1154. J. H. Bailey.
1157. E. C. Bott.
1158. C. F. Bielefeld.
1160. W. Thomson.
1161. J. Stickland.
1164. J. Norie.
1173. C. H. G. Williams.
1179. C. S. and W. Shorrock.
1187. B. Lilly.
1201. T. Parkinson and F. Taylor.
1206. B. Lambert.
1230. J. Hinks.
1231. R. Talbot.
1234. J. T. Newton.
1267. J. T. Markall.
1296. S. E. Rosser and J. G. Jennings.
1338. G. Gore.
1487. I. G. and W. Bass.
1579. S. Robinson, J. Priestley, and J. Foulds.
1724. W. Clarke.
1753. L. M. Bournique and J. B. Vidard.
1754. L. M. Bournique and J. B. Vidard.
2108. T. Westhorp.
2320. W. Elsdon.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2640. T. Neal.
2652. J. Beck.
2656. J. H. Johnson.
2668. D. Joy.
2674. W. E. Newton.
2685. G. Hamilton.
2690. W. E. Newton.
2701. W. Edwards.
2717. W. Hewitt.
2718. T. W. Rammell.
2771. H. E. West.
3067. J. R. Cooper.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2539. T. S. Salt.
2547. J. T. Way.
2741. S. Fox.
2577. J. Nasmyth and R. Wilson.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending October 31, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
532	1 6	593	1 6	604	0 4	615	1 8	625	0 4	635	0 10
583	0 4	594	0 8	605	0 4	616	1 2	626	0 4	636	1 0
584	0 10	595	0 4	606	0 4	617	0 6	627	0 10	637	1 0
585	0 4	596	0 4	607	1 0	618	0 8	628	1 0	638	1 4
586	0 4	597	0 4	608	0 8	619	0 4	629	2 0	639	0 6
587	1 2	598	2 2	609	0 4	620	0 4	630	0 4	640	1 2
588	0 4	599	0 8	610	0 4	621	0 4	631	0 4	641	0 4
589	0 4	600	0 4	611	1 0	622	0 10	632	0 10	642	0 6
590	0 10	601	0 8	612	0 4	623	4 2	633	0 4	643	0 6
591	0 4	602	0 10	613	0 4	624	0 10	634	0 8	644	1 2
592	0 4	603	0 10	614	0 4						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	pct
IRON:—									
Welsh Bars, in London	per ton	7	10	0	to	0	0	0	2½
Nail Rods	do	8	0	0		8	10	0	
Hoops	do	10	10	0		0	0	0	
Sheets, single	do	11	10	0		0	0	0	
Staffordshire Bars	do	9	10	0		0	0	0	
Bars, in Wales	do	6	10	0		6	15	0	
Rails	do	7	0	0		0	0	0	nett
Foundry Pigs, at Glasg, No 1	do	3	0	0		3	8	0	
Swedish Bars	do	11	10	0		13	10	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		16	10	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	105	0	0		0	0	0	3
Hammered Bottoms	do	115	0	0		0	0	0	
Flat Bottoms, not Hamrd	do	110	0	0		0	0	0	
Tough Cake and Ingot	do	98	0	0		0	0	0	
Tile Copper	do	98	0	0		0	0	0	
Best Selected	do	101	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	9	
Fine Foreign	per ton	100	0	0		102	0	0	
TIN:—									
English Block	per cwt.	5	15	0		0	0	0	2½
do Bar	do	5	16	0		0	0	0	
do Refined	do	6	0	0		0	0	0	
Banca	do	6	2	0		6	3	0	nett
Straits	do	5	17	0		0	0	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	9	0		1	10	0	
Second Quality	do	1	7	0		1	8	0	
Coke	do	1	3	6		1	5	0	
SPELTER:—									
On the spot	do	18	7	6		18	10	0	nett
ZINC:—									
English Sheet	do	24	0	0		0	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	35	0	0		0	0	0	2½

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.		£	s.	£	s.
Teak load	£12	0	£13	0	Archangel, yellow	£13	0	13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
„ yellow pine	3	10	4	10	Finlan	0	0	10	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	15	0
Quebec oak, white	5	10	6	10	Gothenburg, yellow	10	0	11	0
„ birch	3	10	4	10	„ white	9	0	9	10
„ elm	3	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderhamn	9	10	10	0
„ fir	2	10	3	10	Christiania, per C., 12ft. by 3 by 9 in.				
Memel fir	3	5	3	10					
Riga	3	0	3	5	Christiania, yellow	21	0	23	
Swedish	2	10	2	15	Deck Plank, Dantzic, per 40 ft. 3 in.	0	16	1	1
Masts, Quebec red pine	5	0	6	0	PUMICE STONE pr ton	5	10	6	0
„ yellow pine	5	0	6	0	**OILS, &c.**				
Lathwood, Dantzic, fm	5	10	6	10	Seal, pale per tun	47	10	48	0
„ St. Petersburg	8	0	8	10	Sperm body	78	0	79	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Cod	56	0	57	0
					Whale, Sth Sea, pale	45	0	46	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	59	0	60	0
St. John, white spruce	14	0	15	10	Cocoanut, Cochin	48	0	0	0
Yellow pine, per reduced C.					Palm, fine	36	0	37	10
					Linseed	42	10	42	15
Canada, 1st qual.	17	0	18	0	Rapeseed, Eng. pale	42	0	0	0
„ 2nd do.	11	0	12	0	Cottonseed	31	0	35	0

FRENCH & SMITH, Sworn Brokers, 4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number.—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 13, 1863.

NON-CONDENSING ENGINES.

Probably one-half the number of stationary engines at work in Great Britain are without condensers; yet there are few complaints of their want of economy, although their use is by no means confined to those districts where coals are extremely cheap; many of them, indeed, being employed in driving mills, factories, and workshops in London, and large provincial towns where fuel is far from plentiful. The extended use of the non-condensing engine goes far to show that its defects have been much over rated, and its advantages too often kept in the background, by a class of engineers who believe that no steam engine is ever to be recommended unless it embodies some of James Watt's inventions in its construction. The fact is, that the wasteful consumption of fuel is so great, as a rule, in our steam machinery, that hundreds of expedients may be adopted which will equally secure a considerable saving, and the condenser is, after all, but one of these. There is no peculiar or occult benefit to be derived from its use, any more than there is from expansion, or high pressure, or a particular method of boiler-setting. The working of an engine with a defective generator may possibly he much improved by the application of a good arrangement for producing a vacuum, and it may still remain very much worse in every way than that of one better designed and constructed in other respects, yet without a condenser. The best kind of steam machinery is not that which depends for success on one good feature. It is to the skilful combination of many good things that we must ultimately be indebted for the attainment of a fair approach to theoretical perfection. It is erroneous to believe that that engine which burns least coal must invariably be the best. We have known colliery proprietors and mill-owners to put down steam machinery at a vast expense, which never paid one per cent. on the additional outlay, by the saving of fuel effected. Thousands of pounds have, ere now, been expended in the construction of reservoirs, culverts, and water-races, in order to supply the demands of a condenser; and this, too, in districts where steam coal of fair quality could be delivered on such terms that the saving effected by the vacuum would not amount to five shillings a day with an 80-horse engine. Economy of fuel, secured by such means, is frequently the most expensive item a manufacturer can invest in.

We do not wish our readers to imagine that we underrate the value of the condenser. Its presence will always be found beneficial, unless peculiar considerations imperatively dictate its absence; but we certainly consider it injudicious in the extreme, to resort to its use in situations where coal is so cheap, that but an insignificant saving can be effected by economy in its consumption; or where water is so distant, that much expense must be incurred before it can be brought in abundance to the engine-house pond. In these cases, it is pleasant to reflect that as good economical results may be, and have been, obtained from high-pressure non-condensing engines, as from any other description of steam machinery. We may cite the locomotive and the portable in proof of our assertion. On many of our great railway lines, the former performs its duties daily with a consumption of but 3·5 lbs. of good coal per indicated horse-power per hour; and any of our large agricultural engineering firms will guarantee a 20-horse portable to work up to that power for ten hours with 9 cwt. of coals, or even less; yet neither class work under circumstances favourable to economy. It is true that in many situations any parsimony in the first cost of steam machinery, or those items requisite to secure a saving in fuel, is injudicious in the extreme—as, for instance, in the case of sea-going ships, and in districts where fuel is scarce and dear; but even then the condenser can only be regarded correctly as an auxiliary, unable, alone, to effect greater results than those which can be produced individually, by good boilers, super-heated steam, high-pressure combined with expansion, and one or two other matters of minor importance. Hence we find the condensing engine not only holding its own, but, actually increasing in favour daily: its simplicity, small first cost, trifling consumption of oil and lubricants, and the slight expense incurred for repairs, rendering it a very general favourite; while the attention which has been devoted to it of late years, and the use of higher pressures, better pistons, and increased speeds, has gradually reduced the consumption of fuel so much, that it bears a very favourable comparison with condensing engines weighing and costing two or three times as much per indicated horse-power.

In comparing the merits of the two systems, it is necessary to remember that slow piston speeds will shortly become a thing of the past. Not only this, but the rotative velocity of our engines, is daily increased in the best practice; engineers and mill-owners finding it better to employ high-speed steam engines, rather than heavy and cumbrous intermediate gearing, to impart the requisite velocity to the driven machinery. Now, it is rather a difficult problem to work pumps successfully—that is to say, without excessive wear and tear of the valves and buckets, and much noise—when they are driven directly by engines running fast with a short stroke. The old-fashioned beam engine, with its costly paraphernalia of pump-rods and parallel motions, was designed far more with a regard to securing the correct action of the exhausting apparatus, than the mechanical properties which are indispensable to the attainment of a high result from the amount of steam passed through the cylinder. Simplicity of arrangement, and reduction in size and weight, were little valued; and steam as a motive power was absolutely unavailable before the introduction of modern improvements, in hundreds of situations where it is now employed with the greatest economy. The high-speed direct-acting engine of the present day, is, as a rule, just as unsuited to putting hydraulic machinery in motion, as the beam arrangement is admirably adapted to that end. A return to the old system is out of the question; and we must either consent to abandon the condenser altogether, or prepare to overcome obstacles, but too well understood by those who have to design our engines for driving the screw-propeller. We have little doubt that the time is not far distant, when the use of a condensing apparatus will be almost wholly confined to a class of steam machinery of the most refined construction, in which every other consideration will be sacrificed to the attainment of the highest possible useful effect from every pound of fuel consumed; such engines can only be required on board ship. The loss from blowing off, entailed by the use of sea-water, is so great, that the weight of a surface condenser and the requisite pumps, is as nothing compared to the weight of the coals saved by their use. It is true, that were high-pressure steam once introduced into our marine, the vacuum would at once lose half its value as a direct agent of economy. Its indirect value in securing a supply of fresh water to the boilers, would, however, be greater than ever; and in such situations, therefore, its use can never be legitimately abandoned. On land, a supply of fresh water to feed the boilers can always be obtained; and it is bad policy to complicate machinery, or reduce piston speed, merely for the sake of the few pounds additional pressure per square inch, which can be realised by a vacuum, obtained at last at an expense and trouble far greater than it is worth.

The value of a condenser depends almost wholly on the pressure of the steam employed. According as this is greater or less, so will the proportion of power derived from the vacuum represent anything, from the entire force of the engine, to a very small per-centage of the work done. Thus, an engine with a positive pressure of but 15 lbs. on the square inch of piston, would give out no useful effect whatever without the condenser. The safety valves of many of Watt's earlier boilers were loaded to but two or three pounds on the square inch, and his engines frequently worked with but 8 lbs. or 10 lbs. in their cylinders above the vacuum. In order to stop them, it was sufficient to exclude the injection. An engine of 100-horse power, working with 28 lbs. or 30 lbs. steam, will derive 50-horse power from the vacuum, and 50-horse power from the positive pressure of the steam; and in such a case, the suppression of the condenser would at once double the consumption of fuel. If 150 lbs. steam were used, however, the vacuum would produce but one-tenth of the power, and save only the same proportion of fuel, even admitting that it was theoretically perfect on the one hand, and that the resistance of the atmosphere to the motion of the piston was equal to its full pressure, on the other. Most probably neither assumption is correct; many engineers stating that the momentum of the escaping steam, is sufficiently great to cause a partial vacuum in the cylinder, if the waste-pipe is long and free from bends. Dr. Alban mentions an instance, where such a tube, constructed of thin sheet iron was crushed flat by the pressure of the atmosphere; while Mr. Scott Burn goes so far as to estimate the resistance to the motion of the piston at but 7 lbs. on the square inch, instead of 14·5 lbs.—a conclusion to which we take exception. A great diversity of opinion prevails as to the real value to be attached to the vacuum, after deducting the power required to work the air and cold water pumps, and to overcome the extra friction induced by their use. We have all heard of extraordinary vacuums, 29 inches of mercury, and so on. We recollect an instance, indeed, wherein we were gravely assured by an engineer that he had seen one of 60 lbs. on the square inch! A vacuum equivalent to 13 lbs. on the square inch is, perhaps, the greatest ever realized for any considerable space of time, and even this is met with only in the best engines, when the supply of condensing water is ample and the temperature low. From this we may safely deduct a pound, to compensate for the force required to put the pumps in motion, friction, &c.; and we thus find the useful effect of the condenser reduced, under the most favourable circumstances, to between 11 lbs. and 12 lbs. on the square inch. Add to this, the fact that condensing engines on land are seldom worked with high steam, while the slow motion of the piston gives time for an enormous amount of condensation to

take place in the cylinder, and we can easily understand how it is that the non-condensing engine can compete successfully with its more theoretically perfect rival. It is true that the condensing engine *could* be made superior to that working without a vacuum; but we are dealing with the question in its present aspect; and we must recollect that if one system is capable of improvement, the other is equally open to that desirable process, while the employment of the condenser is a positive obstacle to the attainment of that speed, extreme simplicity, and admirable facility for adaptation to the end in view, on which the practical perfection of steam machinery so much depends.

Until the principle of expansion is carried out much further than it has been as yet, we must continue to prefer the non-condensing system, so long as the price of coal is not excessive, in every case where water is not at hand in quantity or capital plentiful. A very little additional expense will secure a thoroughly good boiler, capable of carrying high steam with much greater safety than a low-priced one, with steam of half the pressure. A moderately-sized cylinder, carefully clothed, and a piston running at a high velocity, driven by 75 lbs. steam, cut off at one-fifth of the stroke, and slightly superheated, will give out a greater useful effect per lb. of coal than nine-tenths of the condensing-engines in every-day use in our manufacturing districts; while the first cost for foundations, piping, engine, and general fittings, will be reduced nearly one-half. It is of little consequence that the tenth engine is more economical. We may rest assured that that end is obtained at a considerable outlay, and by the sacrifice of many things for which, in all probability, the saving in fuel will hardly compensate. The non-condensing engine has been hitherto undervalued, and treated with a contempt which it certainly does not deserve. Had it received one-half the labour devoted to the condensing engine, it would now hold a very high position as a safe and economical motive power. We would willingly draw the attention of engineers to this class of steam machinery, convinced as we are that they will find in its improvement a fair and remunerative field for the display of their talents.

THE ORDNANCE REPORT, 1863, CONDENSED; AND CONCLUSIONS FROM IT.

No. I.

Report from the Select Committee appointed to inquire into the Expenditure incurred since the beginning of 1858 in various natures of improved Ordnance, whether obtained by contract or manufactured in the public departments, and also the results obtained by such Expenditure. Ordered by the House of Commons to be printed July 23, 1863.

For the charge of 16s. may be had, at the Parliamentary Papers Office, Abingdon-street, the Report of the Select Committee on Ordnance, 1863, an Encyclopædian folio, two inches thick, weighing 5 lbs., and containing nearly 700 pages, and 6,000 questions and answers, with numerous reports and diagrams relating to the construction, manufacture, properties, and cost of guns and projectiles, as well as reports of experiments and the history of the Armstrong transaction. It is a valuable contribution to the science of gunnery, furnishing data and evidence, from which conclusions may be drawn useful to engineers, manufacturers, and artillerists, and highly beneficial to the public interest. Few persons will have the leisure or inclination to read and digest the mass of matter which the huge tome contains. Hence the public are left to form their opinion of the nature and result of the investigation from the analysis of partizan or party writers, who select such parts of the evidence as tend to establish their own objects, theories, or views, and either suppress or gloss over whatever is in opposition to the particular case they wish to prove.

To appreciate and draw correct conclusions from the evidence, to separate the grain from the chaff, is a work of patient research; but the results will repay the labour; and no doubt a condensed *resumé* of the report, in its different aspects, will be acceptable to that large professional and scientific body of men who take an interest in the gunnery question, than which none is of higher national importance.

The Select Committee, it is stated, was appointed "to inquire into the Expenditure incurred since the beginning of 1858, in various natures of improved Ordnance, whether obtained by contract, or manufactured in the public departments, and into the results obtained by such Expenditure." The real purpose of the inquiry was to investigate the circumstances connected with the Armstrong contracts and appointments; but this investigation extended into so wide a field, that it embraced every branch of gunnery, and has been the means of eliciting and registering facts and opinions of much value in every point of view. These have been carefully analyzed and will be presented to the reader in a condensed form under the heads they respectively belong to.

Before entering into the matter, we deem it right to state our impression with reference to the main object for which the Select Committee was appointed by the House of Commons, and we have no hesitation in saying, that the effect of a careful perusal of the voluminous contents of the Report, on any candid and unbiassed mind, would be that the evidence, unmistakeably condemns the Armstrong system of artillery, and censures the Government authorities for its adoption into the service.

The *Times* supports the opposite opinion. It is making desperate efforts to counteract the influence on the public mind which this Report, when understood, cannot fail to exercise. With an air of candour, calculated to mislead, it professes the intention to publish an analysis which shall give both sides of the question, and begins with the evidence favourable to the Armstrong case. The review of this side of the question is executed with the talent which characterizes the writing in that journal, but the spirit of partizanship is apparent in every line. Extracts from the evidence favourable to the system are skilfully grouped and brought into relief, so as to impress on the reader's mind *a priori* the conviction that the country is deeply indebted to Sir William Armstrong, that he is an engineer and artillerist of transcendant genius, and that, up to the time when the Armstrong system was adopted into the service, no other inventions or ideas were deserving of the attention of the Ordnance Department. This is the delusion which has so long been practised. To remove it, is one of the duties we undertake; and it is one, which, with a fair exposition of the evidence furnished by the Parliamentary Report, it will not be difficult to accomplish. The points raised by the investigation are so multifarious that, to avoid confusion, we deal with them separately; and, summing-up impartially, we apply to each the evidence which bears upon it.

Advent and Influence of Mr. Armstrong.

"As almost the whole of the expenditure inquired into (says the Report) was incurred upon Armstrong guns and ammunition, the Committee deem it necessary to commence with a short history of the introduction of that system of ordnance into Her Majesty's Service."

From that history we extract, in chronological order, the following narrative of events:—Mr. Armstrong first appeared upon the scene of his future celebrity, in December, 1854, when he had an interview with the Duke of Newcastle, and obtained from him an order for six guns for trial. The first of these guns, a 3-pounder, was delivered in July, 1855. The Ordnance Select Committee made experiments and a report, which, though qualified, was, in the main, favourable to the gun, and desired further experiments. The gun was rebored up to a 5-pounder, and in December, 1856, was tried near Newcastle in the presence of Colonel Eardley Wilmot, who reported "that at 1,500 and 2,000 yards the gun had made remarkably good practice."

In January, 1857, a second gun was ordered, an 18-pounder, and reported ready on 1st July, 1857; but the trial was delayed, owing to Mr. Armstrong's absence on the Continent, until 26th January, 1858, when experiments were made with it in competition with a service 32-pounder gun. The 5th February, 1858, the Ordnance Select Committee reported the result as highly satisfactory. The 25th February, 1858, two 18-pounders, and on the 13th April, 1858, one 12-pounder and 400 projectiles for the 18-pounder, were ordered for further experiments. About August, 1858, General Peel called upon Col. Lessing for a report on all the experiments that had been tried on rifled ordnance; for which purpose, early in September, 1858, the "Special Committee on Rifled Ordnance" was appointed, with Colonel Mitchell, R.A., as President, and Captain Andrew Noble, R.A., as Secretary. This Committee came so the conclusion that it was not expedient to incur the expense of trying further experiments with any guns but those of Messrs. Whitworth and Armstrong. The 30th September, 1858, a letter was addressed from the War-office to Messrs. Whitworth and Co., expressing the wish of the Committee on Rifled Cannon to visit their establishment at Manchester. The 21st September, Messrs. Whitworth replied, and offered to afford every facility to the Committee to inspect their works. The 2nd October, Colonel Mitchell wrote to Messrs. Whitworth to inform them that the Committee would not visit their establishment till the 5th or 6th November, and they purposed visiting Mr. Armstrong's first. The 30th October, 1858, a letter was addressed from the War-office, by order of General Peel, to Messrs. Whitworth and Co., suspending the preparation of the shell and shot ordered the 1st October, as the Committee on Rifled Cannon had a sufficient supply, and it was not probable that any more would be required.

Between September, 1848, and January, 1859, experiments were made by this Committee, with the Armstrong and Whitworth guns in competition. The Armstrong guns fired 50 rounds of solid shot, segment shells, and shrapnell, and the Whitworth only 9 rounds of solid shot and shell, without bursting charges, Mr. Whitworth not having received notice that firing live shells would form part of the programme. In January, 1859, from the result of these experiments, the Select Committee on Rifled Cannon reported against the Whitworth, and in favour of the Armstrong system, and recommended the latter to be adopted for the field guns of the service. Soon after this report, Captain

Noble became a partner in the Elswick Company, which was formed about this time.

The 18th December, 1848, Lord Derby, in a letter to General Peel, said that "he should rather doubt the expediency, in the present infancy of the Armstrong invention of pressing for the supply of a large number of guns." He suggested that the "first order should be confined to 32-pounders, and that the construction of heavy guns should be deferred till they had been more tested." This prudent recommendation was disregarded.

The 15th January, 1859, Mr. Armstrong assigned his interest in all patents for, and improvements in, the manufacture of ordnance to the Government. The Secretary of State refused to submit these patents to the Committee, an Act of Parliament having been passed to keep the specification secret. Previously to these events, a guarantee was given to Mr. Armstrong, "that he should not be a loser by the expenditure of £12,000 on a plant sufficient to enable him to turn out 100 guns a-year." The 16th January, 1859, a guarantee to the same effect was given to the Elswick Company for £50,000, which was soon afterwards increased to £60,000. The 23rd February, 1859, Sir W. Armstrong was appointed Engineer of Rifled Ordnance, with a salary of £2,000 for ten years, and about the same time received the honour of knighthood. In September, 1859, a Committee was formed to decide upon the "best calibre for naval guns." It was composed of Lieutenant-Colonel George, the President of the Ordnance Select Committee; Captain Sir W. Wiseman, Vice-President of the same Committee; Sir W. Armstrong, the Engineer of Rifled Ordnance, at the Royal Gun Factory; and Captain A. Noble, a partner in the Elswick Company, as Secretary.

Soon afterwards this Committee "approved of the adoption for the naval service of Sir W. Armstrong's 40-pounder, and also recommended that the 6-pounders, 12-pounders, 100-pounders, and 200-pounders should be guns of Sir William Armstrong's construction." (Captain Wiseman's Evidence, pp. 165, 166, 167).

This "Naval Gun" Committee having thus promptly reported in favour of the adoption of of the Armstrong ordnance for all purposes, and completed the work for which it was formed, was dissolved before the close of January, 1860.

After a short interval, on the report of this "Naval Gun Committee," the Ordnance Select Committee reported in favour of "the adoption, for Her Majesty's Service, of all the guns up to 110-pounders; but (says the Parliamentary Report) several of the larger guns were introduced into the service by order of the Secretary of State without waiting for the report of the Ordnance Committee." (Captain Wiseman, p. 169.)

In October, 1859, the guarantee to the Elswick Company was increased to £85,000, and Government undertook to keep the Company in full work.

The 4th November, 1859, Sir W. Armstrong became superintendent of the Royal Gun Factory for rifled ordnance.

Thus, with careful preparation and the cordial co-operation of a great public department, and its subordinates, during a period of five years, were events, contributing to the adoption into the servce of the Armstrong system of artillery—to the aggrandisement of its projector, and the sudden wealth of himself and his coadjutors, partners in a commercial company—first skilfully and patiently elaborated and then, in hot haste, crowded upon each other, till the work was consummated to the exclusion of all competitors.

Everywhere the barriers of official etiquette and obstruction were thrown down before Mr. and Sir William Armstrong, his measures were in all directions a complete success, and he found himself master of the situation, without an opponent, with the entire control of his proceedings in his own hands, and the national treasury at his command.

We shall, in due course, show from the evidence, how the Armstrong party obtained this commanding position, and contrast it with the contemptuousness, indifference, and humiliating treatment, which the evidence shows every other manufacturer and projector of ordnance met with in the Government departments.

ENGINEERING SURVEYING.*

Not many years ago the acquirement of knowledge by mere study alone, was a difficult task from the paucity of books of a sufficiently lucid and comprehensive character to meet the requirements of the student. Thus, many an individual, now standing high in his profession, can tell a tale of struggle and hardship, of difficulties overcome and obstacles surmounted, in the pursuit of that knowledge on which his future depended; while adverse circumstances precluded its acquirement from any source save books; most of them expensive, and nearly all obscure to the neophyte. Professional education is not yet all that it should be. Every man who has attained the meridian of life can bear testimony to the waste of long years in learning that which never served a good purpose afterwards. We have perhaps, all alike waded through books, fifty of whose dreary pages failed to convey the information which might have been condensed within the compass of ten, and pored over volumes until the eyes grew dim and the brain sick, in the weary struggle to extract that knowledge which it seemed the darling object of the writer to surround with a veil of mystery and doubt. Perhaps the text-books used twenty years ago were sound enough in their conclusions and accurate in their calculations and formulæ; but they seldom or never were valuable to the student without the assistance of a master. Applied mathematics, mechanics, and, perhaps natural philosophy, in so far as it embraces hydraulics and pneumatics, may be ranked among the exact sciences; and there is no good reason why a theoretical knowledge of each, as far as it applies to civil and mechanical engineering, architecture, and kindred pursuits, should not be obtained from books without the aid of any oral instruction whatever. It is certain that a judicious course of reading, with carefully selected library, will do much to facilitate the subsequent labours of the student. Many a lad has entered on a regular apprenticeship, so thoroughly self-prepared in all that related to the theory of the profession in which he desired to become an adept, that he has been at once capable of performing many important duties with credit to himself and advantage to his employer. Unfortunately, the works which can be perused with advantage, without the aid of one already skilled in the questions of which they treat, are very far from numerous. They are more abundant than they were in our fathers' days; and even in this admission there is comprised much for which we ought to be grateful. Scientific literature is cheap, and for the most part good; but there is wide scope, notwithstanding, for improvement in the text-books to which the engineer in the full tide of practice will turn for information, as well as the young man commencing his studies. The difficulty experienced in arriving at the exact meaning which an author intends to convey, is usually a measure of his industry or of his skill in imparting information. Careless writing, or too condensed a method of treating a subject, equally add to the perplexity and mental labour of the reader: the author sparing himself at the expense of the student, who cannot be supposed to have a skilled instructor always by his side to supply that which is wanting in the text. How many men write complete, clear, and excellent books, alike comprehensive and comprehensible, we cannot pretend to say; but, judging from the volume now before us, Mr. Merrett certainly deserves to rank among the number.

Commencing with a slight history of the origin of land-surveying, Mr. Merrett carries his readers back to Ancient Egypt, points out that the annual inundation of the Nile destroyed the landmarks, and therefore occasioned a demand for some accurate method of ascertaining the original boundary of individuul property, and goes on to show, that this object was carried into effect in the most efficient manner by Euclid. Thus claiming for the art of land-surveying an antiquity which places it amongst the oldest of the applied sciences. Subsequently; treating of the duties of the land-surveyor, and pointing out their importance from a legal aspect, he brings us to the conclusion of a very readable introduction, in the course of which he explains a few of the principles involved and the nature of several of the instruments employed.

The main portion of the work is divided into six parts, the first of which is devoted to the consideration of that geometrical and arithmetrical machinery—such as logarithms, decimals, geometrical drawing, the properties of angles, parallelograms, &c.—on the accurate working of which, all the operations subsequently described depend for success. This department once mastered—no difficult task, for the definitions are clear, and the explanations and illustrations lucid and ample—the student will find in the second part, an able treatise on the practice of land-surveying, in the simplest sense in which the phrase is understood; to which is added a chapter on plane trigonometry. In the year 1801, and reign of George III., an Act was passed, called the General Enclosure Act; since which there are five Acts of Amendments for the Enclosure of Commonable and Waste Lands, and Allotting Land in lieu of Tithes; Common and Cottage Rights, the claims for which are various in different parishes. Mr. Merrett has a chapter on this rather difficult question of enclosures, the perusal of which will leave little doubt as to the proper course to be pursued by the surveyor in all cases to which the Acts apply.

Part Third treats of levelling, both in a general sense, and more fully as applied to the setting out of railway lines, roads, and canals. Instructions are given at length for making maps, plans, and sections in strict compliance with standing Parliamentary orders. The rules laid down for the setting out of railway curves are, without exception, the simplest and best we have ever met with. Divested individually, of even an approach to complexity, they are totally free from that mass of algebraical formulæ which so frequently renders very simple questions obscure in the extreme to any one but an expert. It is, perhaps, too much the fashion, lately, to clothe very ordinary arithemetical operations in a garb of mathematics, which can serve no possible end excep

* "A Practical Treatise on Land and Engineering Surveying." By H. S. Merrett. London: Spon, 1863.

ministering to the vanity of the writer. Mr. Merrett's book is free from this vice; no trifling recommendation in our eyes.

The calculation of quantities generally, for estimates, forms the subject of the fourth section. The first great item of expense in the construction of a railway is land, which always bears an exceptional value when required for such a purpose. Next to this, we may rank tunnels, cuttings, viaducts, bridges, and embankments. Without tolerably accurate estimates of the amount of work involved in such undertaking, it is hopeless to imagine that they could ever be brought to a successful conclusion in a financial sense, whatever the engineer might accomplish. Mr. Merrett is well aware of the importance of this question, which he treats accordingly at some length and with considerable skill; all the problems being easily worked out by his rules, with little labour and very few figures, the results obtained being, for the most part, sufficiently near the truth to answer every practical requirement. The chapter is not confined to the consideration of earthwork. On masonry, brick, iron, and timber measuring, our author imparts much valuable information within the compass of a few pages. The fifth portion of the volume is a treatise on the instruments used in surveying, plotting, and levelling, and their use; while the sixth and last, consists of a series of useful tables for reference, carefully selected and conveniently arranged. The volume is illustrated by no fewer than forty-one large folding plates.

Could we conclude here, we would be well satisfied; but we would scarcely do our duty did we not point out that many inaccuracies exist in the style of composition, and the language made use of by the author. It is not, perhaps, quite fair to expect a professional man, in considerable practice, to write with much care, or devote that time to a work which is almost indispensably necessary to secure strict elegance of diction. Future editions will, we doubt not, be free from these imperfections; which are of the less moment, in that they seldom or never obscure the author's meaning. As it stands, the book is a thoroughly good one, calculated to supply a great want, and cannot fail to be equally useful to the student, the practical surveyor and engineer.

BIRMINGHAM INSTITUTION OF MECHANICAL ENGINEERS.

The general meeting of the members was held on Thursday, the 5th inst., at the house of the Institution, Newhall-street, Birmingham, Sampson Lloyd, Esq., in the chair.

The Secretary (Mr. W. P. Marshall) having read the minutes of the previous meeting, a large number of new members were elected; and the officers of the Institution were nominated by the meeting for the next annual election.

The first Paper read was a "Description of the Cornish Pumping Engine, with Wrought Iron Beam, and the Pit Work, at Clay Cross Colliery," by Mr. William Howe, of Clay Cross. The engine is one of large size, erected for the drainage of the entire colliery at a single central pumping station, in place of a number of smaller pumps previously situated in different portions of the colliery, and most of them worked by the winding engines. The new engine is made powerful enough to allow of considerable future extension of the workings, having a cylinder of 84 in. diameter, and 10 ft. stroke. The beam was constructed of wrought iron, instead of cast iron, in consequence of the fatal accident at the Hartley Colliery by the breakage of the cast-iron engine beam; it is composed of two large wrought-iron slabs, each rolled solid in one piece, 36 ft. long, deep in the centre, and 2 in. thick throughout, the two slabs being securely braced together by strong cast-iron distance-pieces bolted between them, and a wrought-iron plate connecting them at the bottom in the centre portion, which render the beam thoroughly stiff laterally. The main centre gudgeon is fitted through a strong cast-iron centre-piece, which has a turned boss at each end, fitted into bored holes in the wrought-iron slabs; and large cast-iron washer plates are fixed to the beam slabs and bored through for the bearings of the other gudgeons, which are keyed in them: the entire beam weighs 32 tons. The pit work consists of a lift pump at the bottom of the shaft, which is 418 ft. deep, and two plunger pumps in the upper portion, all 18 in. diameter and worked by the main spears, which are of very strong construction, secured at the joints with wrought-iron straps fixed by turned bolts through bored holes. The quantity of water to be raised by the pumps fluctuates greatly at different seasons, and at the present time a slow speed of working the engine is sufficient to keep the colliery clear of water.

The next Paper was "On the Processes and Mechanical Appliances in the manufacture of Polished Sheet Glass," by Mr. Richard Pilkington, jun., of St. Helen's. The manufacture consists of three processes—melting and blowing, flattening, and polishing. In the melting furnace a portion of the melted glass is collected on the end of the blowpipe, and blown out into a globe, which is elongated by swinging into the form of a long cylinder. In the next process this cylinder is cut open down one side, flattened out into a sheet of glass by exposure to heat in the flattening kiln, and then annealed by gradual cooling. The sheets to be polished undergo a preliminary process of smoothing, two sheets of glass being worked one upon the other by hand with emery and water between; and as their surfaces become obscured, finer and finer emery is used, until they are smoothed free from all defects. The polishing is done by machinery by a number of heavy rubbers supplied with red oxide of iron, working transversely backwards and forwards across the sheet of glass, which is made to travel longitudinally from end to end beneath them. When the sheet has been polished on one side, it is turned over on the machine, and the other side polished in the same manner. The emery used in the smoothing process is sorted into the different degrees of fineness by a simple apparatus consisting of a series of vessels of different sizes, arranged in succession according to size, through which a current of water is made to pass, flowing through each with a velocity inversely proportioned to the size of the vessel. The emery to be sorted is fed into the stream of water entering the first or smallest vessel, in which the current is most rapid, and only the largest and heaviest grains of emery therefore are deposited in this vessel, the finer portions being carried along by the force of the current and deposited similarly in the second and succeeding vessels, according to their degrees of fineness. A series of specimens was exhibited of the glass from the several stages of the manufacture, and also of the emery and other materials employed in the different processes.

The meeting then terminated.

ON THE NUMERICAL EXPRESSION OF THE DESTRUCTIVE ENERGY IN THE EXPLOSIONS OF STEAM-BOILERS, AND ON ITS COMPARISON WITH THE DESTRUCTIVE ENERGY OF GUNPOWDER.

By George Biddell Airy, Astronomer Royal.

1. A little consideration of the changes in the state of the water and steam, which occur during the bursting of a steam boiler, will show that very little of the destructive effect of an explosion is due to the steam which is contained in the steam-chamber at the moment of the explosion. The rupture of the boiler is effected by the expansive power common at the moment to the steam and the water, both at a temperature higher than the boiling-point; but as soon as steam escapes, and thereby diminishes the compressive force upon the water, a new issue of steam takes place from the water, reducing its temperature; when this escapes, and further diminishes the compressive force, another issue of steam of lower elastic force from the water takes place, again reducing its temperature; and so on; till at length the temperature of the water is reduced to the atmospheric boiling-point, and the pressure of the steam (or rather the excess of steam-pressure over atmospheric pressure) is reduced to 0. It is the enormous quantity of steam, of gradually diminishing power, which is thus produced from water during the course of the explosion, that causes the disastrous effects of the explosion: compared with this quantity, the small volume of gas, which may happen to be in the steam-chamber at the time, is, in boilers of ordinary construction, wholly insignificant, and may be entirely put out of sight in the succeeding investigations.

2. If we compare the course of changes, in bursting, in two boilers, a large one and a small one, we see that the order of changes is the same in both; but that to reduce the temperature of a large body of water by a certain number of degrees a large volume of steam must escape, whereas, to reduce the temperature of a small body of water by the same number of degrees, it will suffice that a smaller volume of steam (smaller in the same proportion as the bulk of water) escape. Thus it will appear that the whole volume of escaping steam at a given pressure, and the whole destructive energy of the steam, are proportional to the bulk of water.

3. For measure of the destructive energy of the steam, we must suppose the simplest and most easily measurable case—namely, that the steam, in expanding, drives a piston along a uniform cylinder. It is necessary to ascertain the value of the pressure F when the steam has expanded so far as to have pushed the piston to the distance x: then the measure of the total energy is $\int dx \, . \, F$, the integral being taken from the point where the piston was in contact with the water to the point where the excess of pressure of the steam above atmospheric pressure $= 0$.

4. In the case of gunpowder fired in a cannon, where the weight of the ball and its velocity on emergence are found by experiment, the energy of the gunpowder as acting on the ball will be thus found:—The pressure at distance y being F', acting on a ball whose weight is W, and g being the numerical measure of the acceleration produced in one second of time by gravity ($g = 32{\cdot}1908$ if the unit of measure is the English foot, or $= 9{\cdot}8116$ if the unit is the French metre), v being the velocity at distance y, and V the whole velocity acquired, then the acceleration is $\frac{F'g}{W}$, and therefore $v\frac{dv}{dy} = \frac{F'g}{W}$, $v^2 = \frac{2g}{W}\int dy \, . \, F'$, and $V^2 =$ total integral $\frac{2g}{W}\int dy \, . \, F' = \frac{2g}{W} \times$ total energy, whence the total energy $= \frac{W \, . \, V^2}{2g}$. And if w be the weight of the gunpowder, the energy of one unit-weight of gunpowder $= \frac{W \, . \, V^2}{2g \, . \, w}$.

5. Several years ago (before 1849) I had desired in this way to compare the destructive energy of steam from a bursting boiler with that of gunpowder; and I had requested the assistance of my friend, Professor W. H. Miller, of Cambridge (to whose knowledge of the progress of accurate science in every department of physics I have often been indebted), to enable me to give numerical values to the expressions involved. At that epoch, however, the theories and experiments on steam were not sufficiently advanced, and I was compelled to lay aside the inquiry for a time.

6. In the spring of the present year I requested Messrs. Ransomes and Sims, of Ipswich, to furnish me with an experimental result on the quantity of water escaping from a high-pressure boiler in the form of steam when the valve is gradually opened. This experiment was undertaken by George A. Biddell, Esq., Engineering Superintendent of the Orwell Works. The result was that, when the bulk 22 cubic feet of water in a locomotive boiler was raised to the temperature which produced a pressure of 60 lbs. per square inch, and when after raking out the fire the valve was gradually opened without every precaution against priming, the quantity of water which escaped in the form of steam was 2¾ cubic feet, or one-eighth of the whole.

7. Possessed of this experimental fact, I again referred to Professor Miller for such theories and citations of experiments as might be required. And by his kind assistance I was enabled to com-

plete the investigation. And here I may state that the whole which follows is Professor Miller's, with the exception of the integration of the steam-pressures, the inference from the cannon-experiments, and the comparison of steam and gunpowder.

8. In giving the heads of Professor Miller's theory, I must premise that the temperatures are Centrigade, the unit of linear measure is the metre, and the unit of weight is the kilogramme. The formula adopted as connecting the volume of steam with the volume of water (at maximum density) from which it was generated, is Fairbairn's and Tate's (Phil. Trans. 1860, p. 219). The formula for the number of *calories* required to convert water into saturated steam of temperature T, and the pressure at temperature T, are from Regnault (*Memoires de l'Institut*, vol. xxi., pp. 748 and 728).

9. The first part of Professor Miller's investigation applies to Mr. Biddell's experiment. The steam-pressure of 60 lbs. per square inch is represented by a column of mercury (at 0 deg.) 3·1028 metres in height. Adding the atmospheric pressure 0·76 metre, the entire elastic force of the steam is represented by a column of mercury 3·8628 metres in height. The corresponding temperature of saturated steam, by Regnault's Table, is 152·84 deg. Now the quantity of water is 22 cubic feet, which at 100 deg. weigh 597·1 kilogs., and the heat requisite to raise the temperature of this water from 0 deg. to 152·84 deg. is 597·1 × 154·38 *calories* (the last number being derived from Regnault's formula $T + 0{\cdot}00002\ T^2 + 0{\cdot}0000003\ T^3$, where T for this instance = 152·84), or 92,182 *calories*. When all the steam has been blown off, the 597·1 kilogs. of water are separated into x kilogs. of steam at 100 degs., and $(597{\cdot}1 - x)$ kilogs. of water at 100 deg. [This applies strictly when the steam has blown into a cylinder and has driven a piston, because then there may be such intercommunication of temperature between the portions of steam as will ensure that the final state of the steam is that of saturated steam at 100 deg.; it is probably true or very approximate when the steam has blown out at different temperatures and has been lost in the atmosphere.] To heat $(597{\cdot}1 - x)$ kilogs. of water from 0 deg. to 100 deg. requires $(597{\cdot}1 - x) \times 100{\cdot}5$ *calories*; and to convert x kilogs. of water at 0 deg. into steam of 100 deg. requires $(606{\cdot}5 \times 0{\cdot}305 \times 100)$ $\times\ x$ *calories* (by a formula of Regnault's). Supposing, then, that the amount of heat as measured by the number of *calories* is not altered by the blowing out from the boiler,

$$92{,}182 = (597{\cdot}1 - x) \times 100{\cdot}5 + 637 \times x,$$

whence x, the weight blown out as steam, = 59·8. This, however, is equivalent to only 2·2 cubic feet of water, instead of 2·75, the quantity which Mr. Biddell found to have passed away in steam.

10. Professor Miller supposes the difference to be caused principally by the heat of the mass of iron which surrounds the water; any burning fuel which may have been left in the firebox would add slightly to its effect. It appears best, therefore, to assume the experimental fact, and to infer from it what quantity of heated water we ought to add (in investigations) to the quantity of water really present in the boiler, in order to produce correctly the amount of water which in the experiment was blown out as steam. Now 2·75 cubic feet of water at 100 deg. weigh 74·638 kilogs. Let y represent the number of kilogs. in the bulk of water which may be considered equivalent to the compound consisting of 22 cubic feet of water, the unknown weight of iron, and the unknown quantity of fuel. To heat y kilogs. of water from 0 deg. to 152·84 deg. requires $154{\cdot}38 \times y$ *calories*; and this is the amount of heat in the complex equivalent before blowing off. To heat $(y - 74{\cdot}638)$ kilogs. of water from 0 deg. to 100 deg. requires $(y - 74{\cdot}638) \times 100{\cdot}5$ *calories*; and to convert 74·638 kilogs. of water at 0 deg. into steam at 100 deg. requires $74{\cdot}638 \times 637$ *calories*; and the aggregate of this with the last, or $(y - 74{\cdot}638) \times 100{\cdot}5 + 74{\cdot}638 \times 637$, represents the number of *calories* in the complex equivalent after the blowing off. Making this equal to the number before blowing off,

$$154{\cdot}38 \times y = (y - 74{\cdot}638) \times 100{\cdot}5 + 74{\cdot}638 \times 637,$$

whence $y = 743{\cdot}2$.

Comparing this with the weight of the 22 cubic feet of water alone, or 597·1 kilogs., it appears that the heated materials extraneous to the water produce the effect of 146·1 kilogs. of water.

11. Assuming then that there are really 743·2 kilogs. of heated water, the investigation of the destructive energy proceeds thus:—To heat 743·2 kilogs. from 0 deg. to 152·84 deg. requires $743{\cdot}2 \times 154{\cdot}38$ *calories* = 114,740 *calories*; and this is the quantity of heat for which we must account in every stage of the expansion, when the steam is allowed to blow into a cylinder and drive a piston before it. Now at any instant let w be the number of kilogs. of water converted into saturated steam; T the common temperature of the water and steam; Q_T the number of *calories* required to heat 1 kilog. of water from 0 deg. to T; λ_T the number of *calories* required to convert 1 kilog. of water at 0 deg. into steam at T; P_T the pressure of saturated steam at T in millimetres of mercury at 0 deg.; K_T the same pressure in kilogrammes per square decimetre (all which are given for numerical values of T by Regnault); V_T the ratio of the volume of saturated steam under pressure P_T to the volume of the water at 0 deg. from which that steam is derived (which is given by Fairbairn's formula). Then, forming the expressions for the number of kilogs. of water and steam respectively, and multiplying each by its corresponding number of *calories*, and equating the aggregate to the original number of *calories*,

$$114{,}740 = (743{\cdot}2 - w) \times Q_T + w \times \lambda_T$$

From this formula, with any assigned numerical value of T, w (the number of kilogrammes of water converted into steam) is found in numbers. And V_T, the ratio of the volume of the steam generated to that of the water from which it is generated, is taken in numbers from Fairbairn's formula. And a kilogramme of water occupies one cubic decimetre of volume. Therefore the volume of steam, in cubic decimetres, is $w \times V_T$, of which w are left in the boiler to occupy the place of the expanded water; and the volume of steam expelled from the boiler is $w \times (V_T - 1)$ in cubic decimetres, or $\frac{w}{1000} \times (V_T - 1)$ in cubic metres.

12. Suppose, now, that the steam in escaping enters a cylinder whose section is 1 square metre, driving a piston before it. Let z be the distance to which the piston has travelled (the unit being the metre). Then $z = \frac{w}{1000} \times (V_T - 1)$. And the pressure of the steam on the piston (the unit being the kilogramme) is $100 \times K_T$. Therefore the two elements, the distance of the piston and the pressure upon it, can be calculated numerically for any number of numerical values of T. To find the effective pressure, the pressure first found must be diminished by the atmospheric pressure, or by the pressure of steam at 100 deg., and it thus becomes $100 \times (K_T - K_{100})$. The limit of the length of the cylinder will be determined by finding where the steam pressure = atmospheric pressure. By Fairbairn's formula, 74·638 kilogrammes of saturated steam at 100 deg. (the quantity which escaped in Mr. Biddell's experiment) occupy 122·28 cubic metres; of this, 0·0746 cubic metre remains in the boiler, taking the place of the water from which it was produced; the whole volume expelled is therefore 122·21 cubic metres, and the limiting length of the cylinder is 122·21 linear metres.

13. By these methods Professor Miller calculated the following corresponding values of z, the distance to which the piston has travelled (the unit being the metre), and F the effective pressure on the piston (the unit being the kilogramme). The degrees of temperature are also given, as they are the elements from which z and F are computed; but they are not in any way used in the subsequent calculations.

T. Degrees Centigrade.	z. Metres.	F. Kilogrammes.
152·84	0	42,185
150	1·621	38,356
145	4·743	32,162
140	9·315	26,615
135	14·740	21,663
130	21·541	17,271
125	30·136	13,377
120	40·976	9,943
115	54·708	6,926
110	72·186	4,288
105	94·325	1,991
100	122·21	0

14. The effective energy of the expanding steam, as shown (for instance) by the momentum communicated to a material piston, will be represented by the integral $\int dz \,.\, F$. As the symbolical form of the function F is not known, it is necessary to perform the integration by quadrature. For this purpose I laid down the twelve data of this Table graphically (taking z as the abscissa, and F as the ordinate), and drew a curve by hand through the points so defined. Then I measured the ordinate for each of the values of z; 0, 1, 2, 3, &c. And I integrated them by the formula ½ (first ordinate + last ordinate) + sum of intermediate ordinates — 1-12th sum of second differences; where it is seen that sum of second differences is sensibly equal to — first of first differences. Thus I found the integral

1,131,400,

which is the true measure of the energy of the 22 cubic feet of water at the temperature which produces the pressure 60 lbs. to the square inch, in a hot iron boiler, the units of the energy being the metre and the kilogramme.

15. If this be diminished in the ratio of 743·2 kilogrammes (the fictitious weight of water on which Professor Miller's calculations are made) to 597·1 kilogrammes (the real weight of water), then we shall have for the measure of the energy of the 22 cubic feet of water at the same temperature, unassisted by the hot iron of the boiler,

909,000;

and if we divide the two numbers by 22, we have for the energy of one cubic foot of water a temperature producing a pressure of 60 lbs. to the square inch,

As surrounded by hot iron, 51,400. (This is the practical value.)

Without influence from surrounding iron, 41,300 (This is the philosophical value.)

16. I now proceed with the evaluation of the energy of gunpowder. The formula applicable to cannon experiments is given in Art. 4. Professor Miller referred me to a series of experiments by General Didion, in his *Traite de Balistique*, p. 485. These experiments were made with cannon of four different bores, and with eighteen different charges of powder in each cannon. The first thing to be done was, to find by trial for each cannon, by means of the formula $\frac{W \,.\, V^2}{2g \,.\, w}$ (which for a single cannon may be reduced to $\frac{V^2}{w}$), what was the charge of powder in which the momentum produced bore the greatest proportion to the weight of the powder. It was found to be the following:—

With ball of 12 kilos.,	1·500 kilos. of powder.		
,, 8·07 ,,	1·250	,,	
,, 6·08 ,,	0·875	,,	
,, 4·05 ,,	0·625	,,	

Then adopting these four for comparison among themselves, by the formula $\frac{W \,.\, V^2}{w}$, it was found that the cannon in which the powder was most efficient was that with a ball of 6·08 kilogrammes. Here it may be desirable to state that the bore was 0·1213 metre, the diameter of the ball 0·1182 metre, the length of bore 2·815 metres; and, with the charge of powder 0·875 kilogramme, the velocity of the issuing ball was 400 metres per second. Applying the formula $\frac{W \times V^2}{19{\cdot}623 \times w}$, the energy of 1 kilogramme of gunpowder (as fired in a cannon) is found to be

56,656,

and that of an English pound of gunpowder

25,700,

the units being in all cases the metre and the kilogramme.

17. Comparing this with the numbers found in Art. 14, we have,

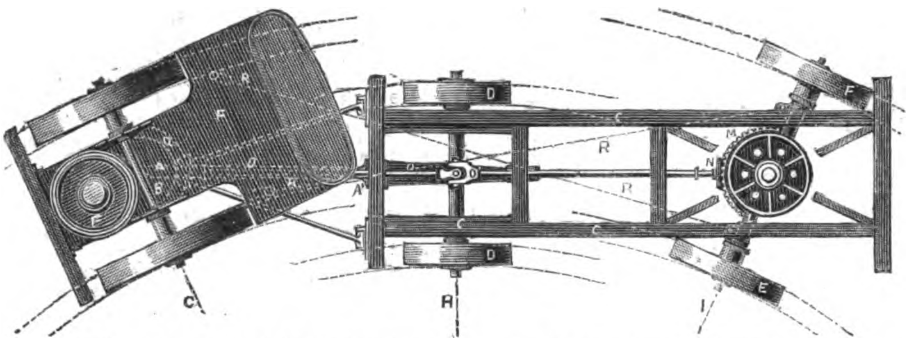
The destructive energy of 1 cubic foot of water at the temperature which produces the pressure 60 lbs. to the square inch, surrounded by hot iron, is precisely equal to the destructive energy of 2 lbs. of gunpowder as fired in a cannon.

18. The destructive energy of the hot water, however, abstracting the effect of the surrounding hot iron, is considerably less than the number used in this comparison; and the destructive energy of the gunpowder, abstracting the effects of windage, cold iron, and short barrel, is considerably greater than the number used for it. Without pretending to form an accurate estimate of these effects, I think that their combination, with that affecting the energy of the water, may have diminished the apparent proportion of the energy of gunpowder by one-half. In that case,

The destructive energy of 1 cubic foot of water at the temperature which produces the pressure of 60 lbs. to the square inch, is equal to that of 1 lb. of gunpowder.

The managing directors of the Thames Shipbuilding Company have formally announced to the Lords of the Admiralty that the "Minotaur" will be launched on the 12th December. The "Minotaur" is 6,621 tons, 1,350-horse power, and she will carry 38 heavy guns.

BARCLAY'S TRACTION ENGINE.



BARCLAY'S IMPROVEMENTS IN TRACTION ENGINES.

THIS invention, patented by Andrew Barclay, engineer, of Kilmarnock, relates, in the first place, to certain improvements in the construction and arrangement of traction engines, which improvements are based upon an invention, of a similar kind, patented the 10th day of March, 1862, No. 646.

Under one modification of the present invention, as applied to traction engines of the "right-angled class," the crank shaft of each pair of engines has its bearings at one end arranged in the side standard or frame, whilst the other end is connected to the main axle or to the centre of the driving wheel, so that this end of the shaft vibrates with the motion of the spring of the driving wheel whilst the other end remains a fixture in its bearing. The other pair of engines have their crank shaft arranged in like manner, the fixed bearings being on opposite sides of the machine. In this way the vibratory motion of the wheels as they traverse over the inequalities of the road, is imparted to one extremity of each crank shaft but without affecting the opposite ends, which revolve steadily in their bearings.

The object of the arrangement is to prevent the vibration of the driving wheels from affecting the beat of the valves. The driving wheels are arranged—one with a long tubular axle to which the wheel is keyed and extending across the framing; the other wheel is fitted with an axle which passes through the tubular one, and is fastened by a nut. Or the two axles may be arranged parallel to rotate in contact, and thus obtain an extended bearing surface when the engines are driven at different speeds. The traction engine is coupled to the vehicle accompanying it by a T-shaped connecting piece which is carried on a vertical spindle, its prolongation passing through two bushes carried by the framing of the connected carriages, the hind wheels of which are connected with the engine by means of a shaft and wheels, or by connecting rods direct, so as to angle along with the engine when going round a curve. This arrangement admits of the lateral and vertical movements of the coupled engine and vehicle. The traction engine may also be guided as well as regulated in speed by means of a duplex break action which is operated by a single hand lever so that the motion may be checked or the break applied to either side of the machine, and so guide it by the different speeds of the driving wheels. The improved pressure gauge consists of a metal or other chamber formed in two parts and divided by an elastic air-proof diaphragm. Above the chamber is fitted a graduated glass tube partly filled with water, which rests on the elastic diaphragm. The pressure of the steam raises the diaphragm and column of water, causing the air to be compressed, and in the ordinary gauges the air escapes through the water when subjected to long-continued pressure, but by interposing the diaphragm of elastic air-proof material this escape is prevented and the gauge continues correct in its indications.

The accompanying drawing, is an outline plan of a traction engine and frame of a truck carriage showing the necessary parts, as arranged in accordance with one modification of this invention, in relation to the coupling of traction engines with trucks or carriages.

The first part of his invention has reference to the aforesaid Letters Patent, and consists in arranging the crank shafts of these engines so that one end upon which a pinion is keyed vibrates with the motion of its supporting spring or springs, but so connected with the main axle of the driving wheels that both vibrate simultaneously in the same direction. This is accomplished by means of a rigid connecting link through which the crank and driving shafts pass. The crank shaft end of this link is fitted with brass bushes, and the crank shaft revolves freely therein; the other end of the crank shaft is supported in the side standards forming part of the main framing, and this end does not vibrate with the supporting spring's action, and in this case the throw of the valves is as regularly wrought by the eccentrics as if both ends of the shaft were stationary as regards the machine itself: the chief feature being the arrangement for allowing only one end of the engine crank shaft to vibrate and not the other.

Another part of this invention has also reference to the before-mentioned Letters Patent, and consists in the connecting of traction engines to their accompanying trucks or carriages, by a T-shaped swivel, coupling bar A, as shown partially in dotted lines in the accompanying drawing. The T-shaped coupling bar A is arranged between the engine and carriage; one modification of it is shown at P and F.

In this arrangement the centre of the shorter vertical arms of the bar A is coupled to the engine framing immediately underneath the centre of the main axle B, and its horizontal arm A^1 is connected with the accompanying carriage, in a manner somewhat similar to that previously described and shown in a previous patent, except that the part of the frame c to which it is attached is formed of iron and hinged to the axle K of the fore wheels D, so that the coupling bar swivels on three centres, on a vertical axis at A, on a horizontal longtitudinal one at A^1, and on a horizontal transverse one at K. The truck or carriage C is supported on four wheels in this modification; and instead of the fore pair of wheels D swivelling on the carriage, it is the rear pair of wheels E, on the axle L, which is made to swivel simultaneously with the traction engine F, shown in plan in the figure.

The fore axle K of the truck or carriage C maintains its position square across the carriage, and the direction of the dotted lines G, J, and I, J, with H, J, show that the angles of the three shafts meet in the centre J, upon which centre the engine turns. The rear axle L is pivoted between two snugs formed on the lower side of the bevel segment M, and this segment is in gear with a bevel pinion N, on the one end of the central shaft O, which shaft has also on its other end a similar pinion P in gear with a bevel segment Q, bolted to the lower side of the engine foot plate, so that any angle given to the engine by the steam steering handle is also imparted to the rear axle L of the truck or carriage, and the whole turns on the required curve without any slipping or slurring of the wheels, as each wheel is loose on its own axle. The shaft O is formed in two parts connected by a universal joint O^1 over the centre of the axle K, where the coupling bar A swivels to suit the inequalities or different levels of the roadway. Instead of the bevel gear just described being employed for actuating the rear axle L, two connecting rods R, R, shown in dotted lines, may be coupled direct between it and the axle B, or to the engine frame at a limited distance behind and parallel to the axle, which will serve a similar purpose, and turn the rear axle L simultaneously with the engine and so as to turn in the same arc. The shaft or shafts of the engine driving wheels may be constructed with an extended bearing surface by making one of these shafts hollow, and the other passing through that hollow shaft. The driving wheels A, A^1, are represented one in vertical section and the other in elevation. The hollow shaft B which is keyed into the nave of its driving wheel A, extends the whole breadth of the engine framing and within the hollow shaft B, the solid shaft C, which is made fast to the nave of its driving wheel A^1, revolves freely either in the backward or forward direction when going round a curve.

In another modification for extending the length of bearing in the driving wheel shafts, the axles B and C are placed parallel to each other at any convenient distance apart, or they may be arranged in almost close contact, the one driving wheel being to that extent in advance of the other, as shown. A novel steam pressure gauge is employed for registering the boiler pressure, which consists in the use of an elastic steam-tight diaphragm between the water contained in an air-tight glass tube and the steam, so that the enclosed air cannot escape down through the water and diaphragm. The contained water, being constant and non-elastic, rises up the small sealed tube from the enlarged space above the diaphragm by the pressure of the steam below it, so as to compress the contained air, and indicate the pressure of the steam by the varying level of the water in the tube, and graduated index divisions on its outside, in accordance with the first adjustment of the instrument.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE ordinary monthly meeting of the above society took place on Saturday, the 6th inst., at 35, St. Swithin's-lane, City. In the absence of the President, Mr. Newton—who, it was announced, was suffering from the effects of a rather serious accident—Mr. John Ives filled the chair, the vice-chair being occupied by Mr. Sanford. After the approval of the minutes of the preceding meeting, and the election and nomination of several new members, Mr. Oubridge proceeded to read a Paper on "A Method of Casting Guns Hollow, and Cooling them from the Inside by a Current of Air."

The reader remarked that the subject which he proposed to consider that evening was one upon which much had been already said and written. He believed, nevertheless, that it was not exhausted; for it was a fact that, as yet, no heavy gun had been produced which answered all requirements. Brass guns had had their day, cast-iron guns had been long used, were at one period almost totally condemned, but were now cropping up again, and much might be adduced in their favour. Wrought iron, in multifarious forms, had been employed in the manufacture of guns, each form having peculiar advantages; but the results, on the whole, were not satisfactory. Steel had also been introduced for the purpose; but, in spite of its great cohesive strength, it had been found impossible, hitherto, to make from it good, sound, and serviceable guns of large calibre. Many practical difficulties stood in the way of its employment in this direction, although certainly some very successful efforts had been made to construct light and small pieces of ordnance of that material. Compound guns, composed of cast and wrought iron—the one encasing the other—had also been tried, with variable and uncertain effects; but as yet no absolute rule had been deduced for the guidance of those whose duty it was to manufacture heavy guns. Time, and the expenditure of much more of the public money, might effect this vast desideratum; but it had not yet been achieved; and it was, therefore, the duty of practical and scientific men, to endeavour to solve the problem "how best to manufacture heavy guns?" He (Mr. Oubridge) intended to contribute a few items to the mass of

existing information on the subject, and he might state that such knowledge as he had to impart, had been gained from his own experience and experiments in the iron foundry. It was required in the production of large pieces of ordnance, that the material used should be made to offer the fullest possible resistance to the bursting strain to which it would eventually be exposed, and that the cohesive strength of that material should be completely maintained. Perhaps, before advancing his own views, he might be permitted to refer to the method of casting heavy guns, which had been largely practised during the unhappy contest which still raged in America. The name of Dahlgren would no doubt be familiar to his hearers in connection with the American civil war; and the guns which were known as "Dahlgrens," possessed some distinguishing features. They were cast hollow, the theory of their invention being that it was desirable "to reduce the neutral axes of his gun as nearly as possible to the centre of the thickness of the metal of which it was formed." This would be clearly seen to be the case from the diagram produced. If, on the contrary, the gun were cast solid, the cohesive power of the metal would be diminished as it approached the centre of the gun. By casting the gun hollow, this deteriorating process would be lessened by the pressure of the core in the mould. Dahlgren had evidently well considered the laws of cohesion and disintegration which governed these results. He had also adopted the plan of assisting the cooling and contracting by pouring a stream of cold air through a tube of iron inserted in the core barrel. In this way he was perfectly right, for it ought to be understood that if the cooling process operated entirely from the outer portion of the casting, it was, to use a familiar illustration, like casting an iron ring upon a mandril—an operation which they all knew would be a senseless proceeding. This plan had, however, been persistently followed until the Armstrong gun was introduced. He (Mr. Oubridge) had, several years before, submitted to the select committee of the Board of Ordnance a scheme for casting heavy guns hollow, but the reply of that body was, as usual in such cases, unsatisfactory. At the same period an American gentleman made some attempts to accomplish, in this country, the same thing, but without success. For his purpose six cupolas were erected near the Charlton Pier, on this side of the town of Woolwich, and the experiments there conducted were of a costly character. The theory was not the less a true one—the defeat lay in its imperfect realisation.

There was no doubt in his own mind that homogeneity would be obtained to a far higher degree in large iron castings if they were made hollow in place of being solid. He had had an opportunity a few months back, indeed, of practically demonstrating the fact. A large hydraulic cylinder, requiring 17 tons of metal to cast it, had to be produced. It was to have a very small hole through the bottom end, where the iron would be 15in. thick. He saw that the intense heat would inevitably melt the core barrel long before the metal composing the cylinder ceased to be fluid. He therefore assumed it to be a favourable opportunity for putting to the test his cherished theory. The casting was to be produced in the foundry of the Messrs. Simpson, at Pimlico; and Mr. Thompson, the manager for that firm, giving his consent, he determined to cool the core by means of an internal current of cold air. The plan of operation was very simple. A perforated tube was inserted in the core barrel, and then communicated by means of a pipe and valve, with the blast. As soon as the mould was filled with metal the valve was opened, and the cold air forced into the tube found an outlet through the perforations, whence it impinged upon the barrel. This latter was also perforated so as to allow of the escape of gases from the interior of the core. The result was a complete success, and the cylinder was as sound and homogeneous as could be desired. The cooling process had thus gone on from the centre, instead of the exterior of the casting. When he had considered that the operation had lasted sufficiently long to prevent the metal remaining in a fluid state, he caused the blast valve to be shut, and in half an hour the core barrel was found to have melted in one place, leaving an aperture 3 in. in diameter. The blast was then again turned on, and in less than ten minutes the barrel became black. By this method, which, as he said was of the most easy application, it was possible to reduce the temperature of the interior of a casting to almost any extent, and in a very short space of time. He desired to throw his mite into the treasury of human knowledge. It was for others to put it out, if they chose, to interest. Perhaps those who might be called upon to produce heavy castings, whether for the purposes of war, or in fulfilment of the more hallowed behests of peace, might be induced to take up the hints he had that night ventured to give. It was to be hoped that the practical founders of England, especially, would be permitted to exercise their own judgment as to the selection of the various irons best suited for heavy gun casting, and that in the manner of producing these castings they would not be hampered by mere theorising or "paper engineers," of whom too many had crept into the noble profession of which he was an humble member. He had a reverence for art and science, and for its practical exemplars, but not even ordinary respect for those who pretended to be its disciples, but were nothing more than pretenders. Mr. Oubridge's Paper was listened to with attention, and was well illustrated by diagrams. On its conclusion a discussion ensued, and this was followed by a vote of thanks. At 11 p.m. the members separated.

PREVENTION OF DECAY AND OXIDATION IN SHIPS.

As the prevention of decay in the timbers of wooden-built ships, and the fouling and oxidation of the plates of iron ships, have received considerable attention from the Admiralty and Merchant Shipowners, the following *resume* of all the specifications at the Patent-office bearing on this subject is given:—

Dipping timber in boiled oil is a very ancient practice, and it would be difficult to trace its origin. In 1739, Alexander Emerton took out the first recorded patent for preserving wood from decay. He prepared the planks or boards with boiling oil in the then old way, and afterwards coated them with compounded poisons, powdered glass and sand cemented with painting colours and oils, laid on as paint. The next patent, which was for preserving copper, or plates of which copper is a basis, was granted in 1790 to Collins and Wyatt. They covered the plates with lead or tin. In the early part of the present century several chemists recommended decoctions, in the form of vegetable poisons, for saturating timber, and thus destroying all animal life in the green wood. None of these poisonous solutions seem to have succeeded; for, had they been found efficacious, their application would have been continued. There was then an interval, during which the stoppage of decay seems to have been abandoned, and dry-rot allowed to take its course. In 1822, John Oxford secured a patent, whereby he undertook to prevent oxidation or decay in iron or wood, by preparing tar in such a manner as to stop the evaporation of the oil contained therein, saturating it also with chlorine gas. This purified oil is then mixed with 100 parts of white lead—or of the red oxide—25 parts of carbonate of lime, and 25 parts of purified coal tar added to the oil of tar. These ingredients are then applied as a paint. In the first days of iron in ship-building, rust was found to be a drawback to its general introduction. Scientific men saw the disadvantage, and sought to remedy the defect. Galvanic action, it was considered, would set all right, and the earliest patent in this direction was taken out by G. G. Bompass, in 1830. He sought to preserve metals from corrosion by an electric or galvanic process. For copper to be protected in sea-water he attaches an alloy of 9 to 10 parts of zinc with 100 parts of copper. In protecting iron he employed an alloy of tin, consisting of from 10 to 150 parts of tin combined with one of zinc. Following in the footsteps of Mr. Bompass, in the same year, Mr. John Revere patented an invention for fixing zinc protectors to the brass or stud of chain cables, and other iron surfaces exposed to the action of salt water. These galvanic zinc protectors were rivetted or soldered on according to requirement. It is known that one of the most distinguished of our electricians is in favour of inserting strips of zinc in the plates of ships; but if this principle proved correct in practice, it would long since have been universally adopted. Zinc plays an important part in patents for the prevention of oxidation. In 1837, Jacob Perkins got protection for a plan of coating copper tubes of boilers with a preparation consisting of two-thirds of zinc with one-third of copper; but he had been preceded in 1832 by Captain H. W. Craufurd, R.N., who proposed to preserve copper and iron from oxidation by coating with zinc paint in a fused state. Over this he laid a second covering of pure tin, or tin alloyed with lead. Captain Craufurd explains in detail his method of compounding the ingredients. In 1838, Le Comte de Fontainemoreau, considering Captain Craufurd's mode of fixing or adapting the zinc to this purpose as erroneous, applied for a patent of a more comprehensive description, for applying the zinc coating to metals. Again, in 1839, Mr. Thomas Dowling patented what he terms a conservative bath, applied to metals after grinding. He describes the machinery by which he effects this, the chief of which is a zinc wheel and galvanic vapour furnace.

In 1840, Mr. J. B. Neilson came forward with his invention for the application of a coating of copper, or copper alloyed with zinc or tin, or both, to the surface of iron. This was done by covering the mould to be cast with the material. In malleable iron, dried borax or flux is spread over the iron, which is then prepared with alloy heated to a temperature sufficient to melt copper, and, in its heated state, plunged into cold water to detach the scale of oxide. Mr. Arthur Wall, likewise in 1840, mixed 20 lbs. of the strongest muriatic acid diluted with three gallons of water, then added 12 lbs. of steel or wrought-iron filings. The filings were heated to redness before mixture. The whole was then subjected to heating in a pan, &c., and the composition was then applied to prevent corrosion. In 1841, Mr. W. E. Newton employed silicates of potash, or soda, for making a plaster or coating to prevent iron from becoming rusty. After him came Professor R. Mallet, engineer, of Dublin, whose varied processes are of the most complex character. Finding that iron covered with zinc, when immersed in sea water and certain fresh waters, gathered to itself a coating of carbonate of lime, destructive to the protective power of the zinc, and affording a surface for the attachment and growth of marine animals of the molluscous and testaceous classes, and aquatic plants, he applied chemical means to detach the scales of oxide from iron, and then plunged it into a preparing bath. After undergoing a series of processes, the metal is coated with an alloy or zoofagous paint, which paint is rendered poisonous by admixture of salts of metals, by means of which he sought to render the zinc effective as an anti-corrosive protector. In 1841, also, Mr. E. Morewood endeavoured to preserve iron from oxidation or rust by thinning it, and then dipping the tin covering or surface in molten zinc. Moses Poole, in 1845, claimed to possess an invention whereby he rendered iron more hard and durable, and free from oxidation, by the use of ferrocyanide of sodium, calcium, barium, or any other alkali, or alkaline earthy base; to be used in a manner fully set forth in his specification. In 1856, Mr. Andrew Smith improved upon the plans for melting the zinc. He employed a bath of lead or tin, or any composition or medium that melts at a lower degree of heat than zinc, by which means the heat from the fire of the furnace is taken up and transmitted to the receptacle containing the zinc for melting. Baron Wetterstedt, in 1846, added the regulus of antimony to lead sheets, combined copper with antimony, made sheet metal by using lead and tin, and lastly, protected metals by paints thus prepared:—1st. One part of regulus of antimony to three parts of copper, mixed, melted together, run out into water, and then heated gently. Two parts of oxide of copper are added, and moistened with naphtha. The whole is then added to a composition of tar and naphtha. 2nd. Another paint is compounded of 30 lbs. of tar, 80 lbs. of pitch, 20 lbs. of dried soot, 4 lbs. of tallow from sperm oil, and naphtha added for consistency.

Mr. C. H. Paris, in 1849, coated metals with glass or vitreous matter. The metal went through a cleansing process. Gum water is then applied, and over this the dry or powdered glass is shaken, and then fused by heat till a glass surface is formed. Mr. Paris claimed the application of carbonate of soda for applying glass in this manner. Mr. J. Macintosh, in 1852, made a paint from decomposed india rubber, in combination with oils or fatty matters saponified by metallic salts, with lime for thickening the liquid. For bottoms of ships he recommends the india rubber, when in a fluid state, to be combined with metallic soap, thickened with lime and coloured by pigments. Messrs. Hughes and Firmin, in 1852, manufactured lamp-black from the vapour of coal tar, dead oil, dead oil salts, coal pitch, naphtha, linseed oil, and other materials. From the products a fuel is produced, and this residue has by another inventor been mixed with oils, ground, and made into a paint. In 1852, also, Mr. R. M. Glover took out a patent for a preparation of arsenite of lead and arsenite of copper, and the red and yellow sulpharets of arsenic. The proportions of each were as follows:—Two parts, by weight, of arsenite of lead, one of realgar, one of orpiment, and one of arsenite of copper.

(To be concluded in our next.)

INGLIS' IMPROVEMENTS IN STEAM BOILERS AND ENGINES.

This invention, patented by Mr. W. Inglis, engineer, Edinburgh, relates partly to improvements in steam boilers, suitable more particularly, although not exclusively, for land engines, such improvements having for object reduced cost, facility for cleaning and repairs, and an efficient circulation of the water in a direction opposite to that of the fire gases, combined with a disposition of parts inducing the deposit of sediment where it can do comparatively little injury. It also comprises improvements in some of the details of land engines, although not exclusively confined to such engines.

In the accompanying drawings two modifications of the improved boiler are shown, figs. 1 and 3 being longitudinal vertical sections, and figs. 2 and 4, transverse vertical sections partially in end elevation.

In these modifications the principal heating surface consists of a series of comparatively long parallel tubes A with the water inside them, and fitted into end casings B, C, this combination being mounted in a position somewhat inclined from the horizontal. Excepting in the modification represented in figs. 3 and 4, the furnace D is placed beneath the higher portion of the tubes A, whilst the tubes are enclosed in a brick or other casing E in such a way as to cause the gases, after entering amongst them, to pass along them towards their lower ends. At the lower end of the tubes A the gases enter a flue F communicating directly with the chimney, but which may, if preferred, be made to pass first in contact with the other external parts of the boiler. The end casings B, C, are, by preference, arranged so as not to be directly exposed to the fire gases.

In the modification represented in figs. 3 and 4, the furnace D is placed above the inclined tubes A; and the fire gases, after passing along beneath the upper receiver H of the boiler, descend amongst the tubes A at their higher end, and then pass along them towards their lower end, and finally proceed along the flue F to the chimney, as in the other modifications. In this modification it is intended to introduce a forced air current under the grate. The steam generated in the inclined tubes A in the several modifications passes along them in the opposite direction to that of the fire gases, and enters from their higher ends into the higher end casing C, and thence, by one or more short tubes or connections G, into one or more upper receivers or vessels H, placed horizontally, or nearly so, above, and provided with the usual steam dome I. The upper receiver or receivers H communicate, by one or more tubes or connections J at the other end, with the lower end casing C below; and the result of these arrangements is that a very energetic circulation of the water takes place. The water-surface level is in the upper receiver or receivers H, and the steam, in rising into the same, carries water along with it towards the higher ends of the inclined tubes A into the higher end casing B, and into the receiver or receivers, whilst a corresponding amount of water returns downwards at the other end into the lower end casing C, and thence into the lower ends of the inclined tubes A. A strong current will consequently continually pass through the inclined tubes A, which are exposed to the fire gases and prevent deposits in them, the deposits, if any, taking place at the turn of the current in one or both end casings B, C, which casings are not directly exposed to the fire gases.

The improvements in steam engines are applicable to the gear for working steam admission valves, when (as in the "Corliss" engine) such valves are arranged to close by the action of weights or springs. One improvement consists in substituting rubber springs or spiral steel springs for the weights or blade steel springs hitherto used, the object being to avoid noise and liability to breakage. The application of this improvement is shown in the accompanying drawing. The admission valves of the steam cylinder A are actuated by rocking spindles B, having levers C on their ends. The lower ends of these levers C are actuated by rods D from the rocking disc or wrist plate E, which last is worked by the eccentric rod F, and which, by the rods G, also actuates the exhaust valve levers H. The upper ends of the admission valve levers C are linked to discs I, which work in the dash pots J, used in this class of valve to prevent concussion. The discs I are formed with spindles which work through the backs of the dash pots J, and are connected together by the rubber spring X, one spring thus serving for both valves. In fig. 6, a spiral steel spring Y is shown as applied in a similar way, excepting that it is connected to the same ends of the valve levers C as the rods D, as it reacts expansively, whilst the rubber spring X reacts by contracting.

In figs. 5 and 6, two modifications are shown of improved adjustable releasing gear. In that shown in fig. 5, each rod D has jointed to it a catch L, acted on by a spring, and arranged to lay hold of the block M, jointed on the pin of the valve lever C, and arranged to slide on the end of the rod D. The catch L has jointed to it a toe lever or bell crank N, which bears on the block M and lifts up and releases the catch at the proper time. The toe lever N is connected by a link P to a lever Q, adjustable by the governor rod R, or it may be by hand. It will

INGLIS' STEAM BOILERS AND ENGINES.

FIG. 1

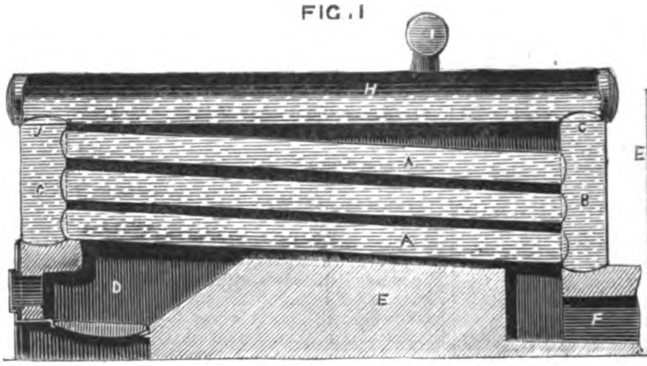


FIG. 2

FIG. 3

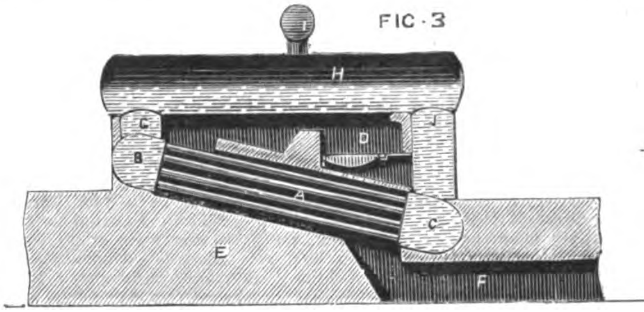


FIG. 4

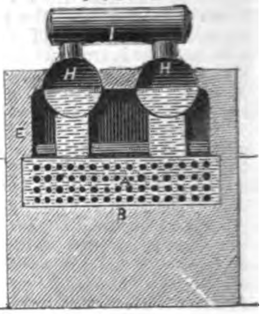


Fig. 5.

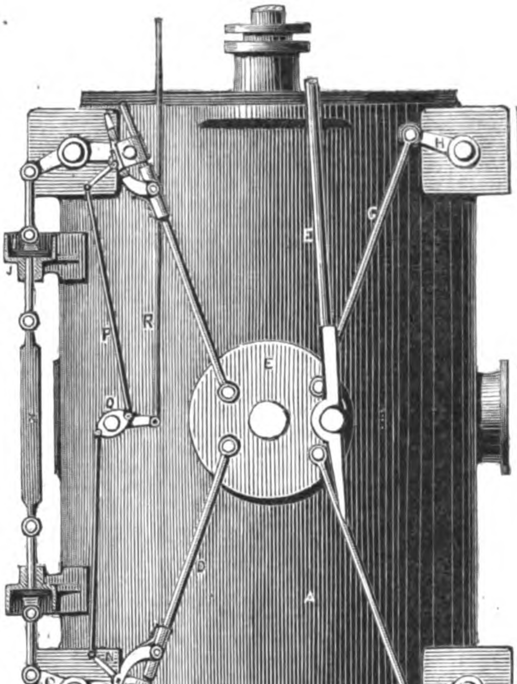
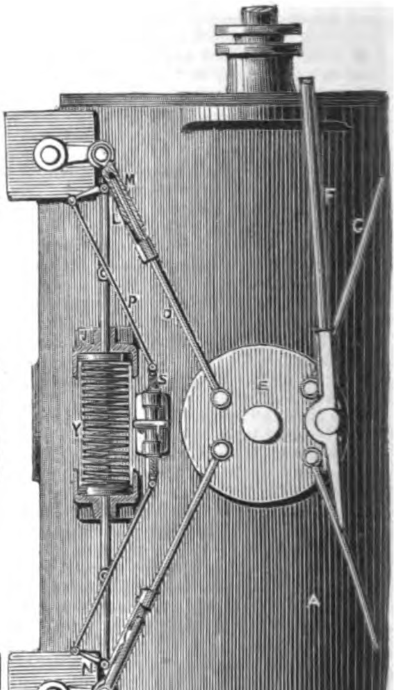
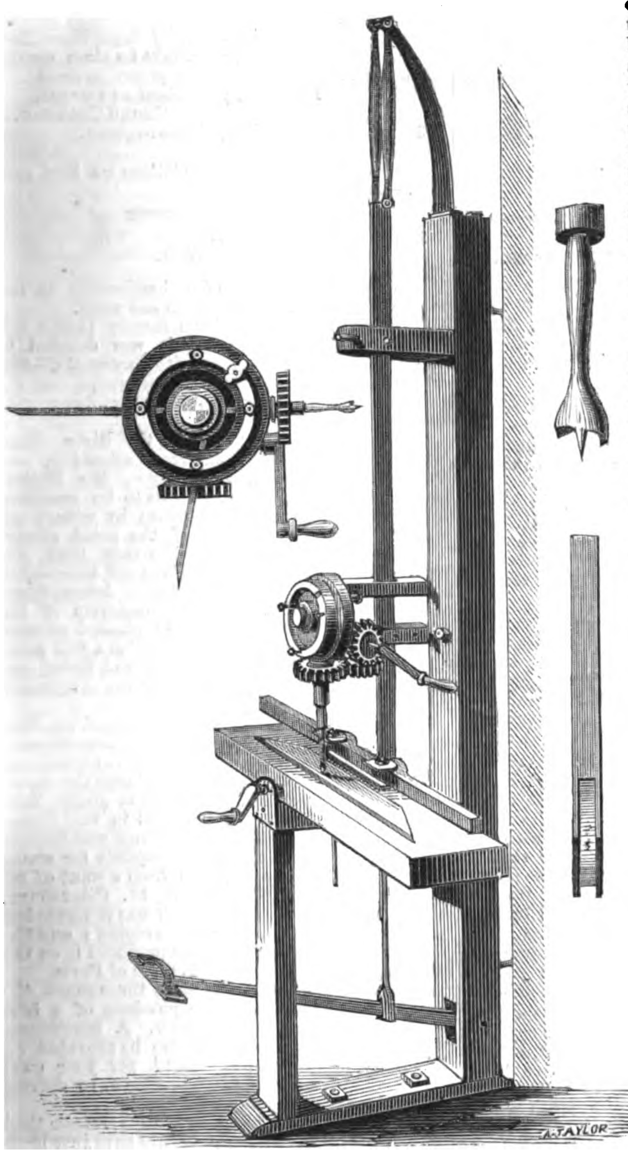


Fig. 6.



GERISH'S MORTISING AND DRILLING MACHINE.



be seen that the relative motions of the parts will cause the release to take place at an earlier or later period of the stroke, according to the adjustment of the lever Q, to which both links P are jointed. In the modification shown in fig. 6, the rod D is fitted to slide in a short rod M, jointed to the valve lever C, and is held in gear by a spring catch plate L, acted upon by a toe lever N, as in the other modification. The links P are jointed to spindles S, having right-handed and left-handed screw threads, and adjusted by means of a hand wheel T, internally screwed to correspond. When the adjustment is effected by means of the governor, a spring may be introduced to act in the opposite direction to the governor.

GERISH'S MORTISING AND DRILLING MACHINE.

Messrs. Gerish and Weston, of Shoe-lane, Holborn, have recently patented an improved machine for drilling and mortising wood, principally intended for manual labour, although it can be driven by power if required. When worked by a man, the motion is given by a treadle, where the whole weight of the body can be applied without any inconvenience, and the hands left at liberty. One end of a connecting rod is attached to the treadle, and the other to a vertical or upright bar, by which means this bar, on which the stock is fixed, moves up and down through two guides with comparatively very little friction; at the top end of this bar a couple of india-rubber springs are fixed, which bring the bar up at every stroke. The stock or tool holder, according to this invention, is made to slide up and down the bar and set at any required distance by means of a couple of set screws; it is made circular so that all the tools work from a centre; a pair of chisels are provided to each size, and eight sizes are supplied with each machine; these chisels are sure to follow in the same mortise when changed from right to left or *vice versa*, which is not the case where only one chisel is used. Very simple means are adopted to set the chisel on an incline to cut the wedging; a swivel is introduced in the back plate, which has an eccentric slot cut in it, and which is turned round by a knob or handle, into which slot a spring catch is made to fall; turning the swivel one way will set the chisel perpendicular, and the reverse way on an incline of 1 in 10 for wedging. Attached to the stock is a drilling apparatus suitable for wood or iron. The table is made to move backwards or forwards by means of an handle working a screw, and is made fast by a fly nut underneath. The fence is shifted up and down through the bed and is made fast by a couple of nuts. The chisel is a very ingenious contrivance for bringing the stuff out when cut; it will bring out two-thirds of the cut at each stroke, and the remainder will fall out, requiring no core-driver, and consequently effecting a very great saving of time and expense. The accompanying drawing illustrates the general appearance and details of the machine.

SYMONS' MARINE BAROMETER.

This barometer, patented by W. Symons, F.C.S., and shown and described at the recent meeting of the British Association, while equal both in accuracy and general appearance to the usual more expensive standard barometers, as Fortin's, &c., is superior to them in lightness, cheapness, and the ease with which an accurate reading may be taken, even by persons unaccustomed to such instruments. It is a modification of Gay Lussac's well-known syphon barometer, but is free from two objections to that instrument—viz., the want of a ready method of making it portable for carriage; and each limb of the syphon being read off by its own vernier, a calculation is required to get the final result. This is avoided in the new instrument, by dispensing with the bottom vernier and scale, and substituting an internal continuous metal tube, which is adjusted by a rack to the surface of the mercury in the short limb of the syphon. The scale and vernier are attached to the upper part of this internal tube, and read off in the usual way. In practice it is found much easier to adjust this instrument than, as is usual in most standards, to bring an ivory point just into contact with the mercury in the cistern. The barometer is rendered portable by a peculiar construction at the bottom of the short limb of the syphon, in which is inserted a steel wire carrying a piece of leather; this is moved up and down by a small knob, and a very small movement perfectly stops the flow of mercury.

A modification of this barometer for marine purposes was shown at the recent meeting of the British Association; and the inventor believes it is the first marine barometer with a full and accurate scale; the best now in use, having, of course, a scale contracted in proportion to the relative capacity of the tube and cistern. When the glass tube is broken, the instrument cannot be accurately repaired, unless the new tube be exactly the same size as the first. In the new instrument, no such absolute identity is required between the old and new tubes to ensure accuracy. At the same time the chance of breakage is less, not only from the lightness of the complete instrument, but Admiral Fitzroy has stated that the usual Board of Trade marine barometers have been broken by the vibration caused in firing a large gun; this, no doubt, has arisen from the necessity of fixing the glass tube firmly into the iron cistern. In the new instrument the tube may be entirely supported by elastic material without interfering with the accuracy of the instrument.

AN AMERICAN IRON-CLAD.

The iron-clad war-ship "Dictator," which is now being built at the large engineering establishment of Chas. Delamater, Esq., foot of Thirteenth-street, New York, from designs by Captain Ericsson, is based upon the principles of the first "Monitor," but will be different so far as relates to capacity, speed, sea-worthiness, and impenetrability to any armour vessel yet built in our country, or that is now being constructed, excepting its consort, the "Puritan." Some additional facts in relation to this vessel will be of general interest. The extreme length of the "Dictator," over all, is 314 ft.; its aft overhang being 31 ft., and forward overhang 13ft., leaving 260 ft. between perpendiculars; extreme breadth 50 ft., and depth 22½ ft. The hull, in sides and frame, is constructed of iron; the water lines are easy and the model good. The armour shelf extends outside of the hull 4 ft. on each side, and is prodigiously strong. An idea of its impenetrable character will be derived from the following account of its construction. The outside is covered with six one-inch plates of iron fastened in the most substantial manner, and inside of this are 3 ft. of oak timber and an armour lining formed of 4½-inch bars extending all around. The armour shelf, therefore, consists of 10½ in. in thickness of iron and 3 ft. of timber; and between the metal and timber is interspersed a thick layer of felting. No gun yet fabricated can project a shot that will pierce this armour jacket.

The keel plate of the "Dictator" is of 1-in. plate the side plates ⅞ in., and the frame of double angle-iron, 6 by 4 in. The interior is divided into several water-tight compartments by plate bulkheads, and the space forward of the third bulkhead below will be used for coal bunkers, through the middle of which will be a railway to carry the fuel to the boilers. The deck beams are of kyanized oak, and all the materials employed in the construction of this great war-ship appear to be of the best quality.

Two engines, each having a cylinder of 100 in. in diameter and 4 ft. stroke, will be employed to drive the screw, which is four-bladed, 21½ ft. in diameter and of 34 ft. pitch. Steam will be supplied from six large boilers capable of furnishing 5,000-horse power to the engines, and it is reasonably expected that the "Dictator" will have a high speed. As it is to be furnished with a strong iron bow, its speed, strength, and mass will render it a most efficient steam ram. It is to be provided which one revolving turret for carrying two of the most formidable guns with which it can be furnished; and it will be as impenetrable to shot of the most powerful guns as the solid rock of Gibraltar. The inside diameter of the turret will be 24 ft in the clear; a turret directly enclosing this will be formed of six thicknesses of inch plate, rivetted together; and over and outside of this will be another turret, forming a sleeve, consisting of seven thicknesses of inch plates rivetted together, and between these two circular shields, solid hoops or bars, 5 in. in thickness, will be packed and fastened securely; the whole forming one great revolving iron tower 18 in. in thickness, 27 ft. in diameter, and weighing about 200 tons. The design of the "Dictator," the care bestowed

upon its construction, and the excellent workmanship displayed upon every part of the hull and machinery, will render this vessel a credit and a powerful defence to our country. Every effort is being made to advance the work as rapidly as possible, and the launch may be expected in about three weeks or a month from the present date.—*Scientific American.*

GOVERNMENT EXPERIMENTS ON STEAM COAL.

It has long been a keenly contested question between the Northcountry and Welsh colliery proprietors as to which of the two classes of coal was best adapted for generating steam, and several experiments have been made by Government authorities without any definite result being arrived at. In consequence of the repeated applications made by the Northcountry proprietors, a series of experiments, extending over five weeks, have just concluded at the Devonport dockyard. The Admiralty were induced to make these experiments in consequence of the assertion of the Northcountry owners that a judicious mixture of the Northcountry or Hartley coal with the South Wales steam coal was far superior for the purposes of steam coal than either taken separately. The South Wales proprietors, feeling the importance of the issue, appointed Mr. Tomlinson, locomotive engineer to the Taff Vale Railway, as their representative. The *Times* states that, although several weeks must elapse before the official report is printed, it may be affirmed that the results will show that in no way has the superiority of the Welsh coal been affected; but, on the contrary, none of the mixtures experimented upon came up to the generating powers of the Welsh coal taken alone. This must be a gratifying result to the South Wales owners, who, in addition to the Navy, have been supplying for some time past large private steamship companies—such as the Royal Mail, Peninsular and Oriental, and Cunard lines, which fact may be taken as presumptive evidence of the superiority of the Welsh coal, as these companies have every inducement to purchase the best article in the market. It is probable that when the official report of these trials is published the question of Welsh *v.* Northcountry steam coal will be permanently settled.

Meetings for the Week.

Mon.—*Medical Soc.*, "Clinical Discussion," at 8.30 p.m. *British Architects*, at 8 p.m.

Tues.—*Inst. Civil Engineers*, 1, "Discussion on Red Sea Lighthouses." 2, "On the Duty of the Cornish Pumping Engines," by W. Morehead, jun., at 8 p.m.

Wed.—*Geological Soc.*, 1, "On the Fossil Corals of the West Indies." Part II. By P. Martin Duncan, M.B. 2, "On some Miocene Mollusca from Mount Séla in the Island of Java," by H. M. Jenkins, Esq., F.G.S. With a Note on a new Coral from the same locality; by P. Martin Duncan, F.G.S. 3, "Notes on the Geology of Japan," by Captain Bullock. Communicated by Sir R. I. Murchison, K.C.B., at 8 p.m.

Thur.—*Antiquaries*, at 8 p.m. *Linnean*, at 8 p.m.

Fri.—*Architectural Assoc.*, Class of Design—Single Bay of Large Church.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

T. F. (Newcastle).—We are quite in the dark, both as to the horse-power developed, and the coal consumed per hour, by steam fire engines.

T. Y. (Edinburgh).—An article appeared some weeks ago on boiler incrustation, in the Mechanics' Magazine, to which we must refer you. Easton's boiler fluid has been used with great success on the Great Eastern Railway, and in many other places.

Civilian.—This controversy is becoming too speculative and personal for our columns. We recollect an instance where a similar discussion was carried on for weeks in the pages of a contemporary without leading to any useful result; we therefore cannot think the insertion of any further letters on the subject advisable.

Paper Drapery.—Apply to Mr. Arthur Grainger, 308, High Holborn, W.C.

Correspondence.

SOCIETY OF ENGINEERS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—You remark, in your leader on the above Society, in your valuable journal of the 6th inst., that you "deem it best not to publish" the discussion that occurred there on the 2nd inst., hinting that "personalities" are out of place "in scientific discussion."

Now, I will ask you if you ever attended the meetings of the Institution of Civil Engineers, and if you ever heard much else than personalities at that place? At our Society, we have no inducement to refrain from speaking what we know, and no fear of offending this party or that; neither do we hesitate to say what we know, because Mr. This, That, or the Other does not hold the same views as ourselves; therefore it seems to me that you err in considering the remarks made by the various speakers as "personal."

The Society does not publish in scientific journals the discussions that take place at its meetings, only the Papers; and possibly the truthful way in which matters are stated by those present might be considered "personal" if it did so; but an abstract of each discussion appears in the "Transactions," published by Spon.

You remark that the use of gas in the furnaces of the steam fire-engine, at Watling-street, is beneficial as to getting steam quickly. This is not the case in practice; for I can refer you to cases where those engines have come to a fire with but 20 lbs. of steam, whilst other engines have started with cold water, and only lighted their fire on receiving the call, and arrived with steam of 100 lbs. on the inch, and got to work some time before the gas-fired engines could do so, and, as far as I can learn and observe, there is no benefit in practice obtained by its use.

I perfectly agree with you that a governor, or some equivalent, is necessary for the steam fire-engines with crank motion. This is proved by their continually breaking down; in fact, out of five fires attended by these engines, there have been serious breaks down at two—to say nothing of their requiring the free use of a pinch bar to help them along. My own observation convinces me of the superiority of a slow, steady, long stroke, as we find greater results produced in practice with less wear and tear, and no breaks down.

Yours, &c.,

A Member of the Society of Engineers.

London, November 7, 1863.

[We regret that our correspondent's note conveys the, we trust erroneous, impression, that the distinguishing feature of the discussions carried on by the Society of Engineers is personality. Far from denying the charge, he sets up the example (?) of the Institution of Civil Engineers as a justification, and goes on to state that we are in error in considering the remarks made as being personal; we prefer that we should be deemed so, rather than justify ourselves at the expense of a Society which has our best wishes for its prosperity. We shall be glad to see the statements contained in the latter part of the foregoing letter rationally discussed by our correspondents.—Ed. M.M.]

COLBURN *v.* CLARK.

Sir,—Even in finally abandoning his attempt to appropriate my ideas as his own, Mr. Clark cannot refrain from making rash and untruthful statements. To his unwilling admission that he had consulted my writings in preparing his contribution to the *Encyclopædia*, Mr. Clark adds the statement that his former assistant is in my employment. This is untrue; but were Mr. Dredge really in my service, I cannot see why, as a gentleman, his word should be the less worthy of credit on that account. If by "peculiar language," Mr. Clark refers to the curse which disgraced one of his former letters to me, I may remind him that he showed that letter to at least one person before sending it to me, and that when I showed it also to the same person (as I did to several others), he recognized the offensive expression at once. All this, however, has little to do with Mr. Clark's statement to you of September 25th last, and which, I think, must take its place among the boldest attempts at literary piracy on record.

I am, Sir, your obedient servant,

Zerah Colburn.

3, Upper Bedford-place, Russell-square.
November 11, 1863.

[We cannot insert any more letters on this subject.—Ed. M. M.]

Miscellanea.

The foundation stone of a breakwater at the mouth of the river Tees was laid last week.

At a recent meeting of the Mersey Docks and Harbour Board (Liverpool), it was decided to apply to Parliament for powers to borrow £875,000 for the construction of new dock works, on the Liverpool side of the Mersey, principally intended for the steam trade.

The cultivation of cotton in the River Plate territories is attracting universal attention, and the testimony of Mr. Hutchinson, the British Consul at Rosario, is conclusive as to its practicability and the vast regions which by nature are adapted for the production of the great staple. The Buenos Ayres *Standard* states that the Governor of Corrientes had received and distributed a ton and a half of seeds of different descriptions, and, after remarking that the majority of the estancieros of that province had planted or were about to plant cotton, predicts that "in a few years cotton will take the place of wool and hides, and become the first staple article of the Argentine Republic."

The Emperor's speech on the opening of the Session consisted of 2,044 words. The transmission by telegraph from the central station in Paris commenced as soon as it was ascertained that the reading had been completed, which was at about half-past 1. The average time occupied in the transmission to the principal cities of France and Europe was an hour and a quarter. The capitals for which the longest time was required from a want of direct communication were Rome, St. Petersburg, Athens, and Lisbon. The speech was nevertheless received everywhere before the evening; and the journals of the whole of Europe produced it on the following morning, the same as those of Paris.

The Ancient Order of Foresters throughout the country are contemplating the purchase of a lifeboat in connection with the Order. A boathouse, with all its requirements, will also be provided by the society, and it is stated that 1d. per year subscribed by each member will be sufficient to defray the expenses of maintaining it.

We learn from the *Army and Navy Gazette* that experiments of an important nature have just been made at the fortress of Carlberg, in Sweden, upon the respective merits of armour-plates made in England, France, and Sweden. Messrs. John Brown and Co., of Sheffield, sent two plates, one 12 ft. by 2 ft. 6 in., and one 6 ft. by 3 ft. 8 in. Messrs. Petin, Gaudet, and Co., of Lyons, sent two plates, each of 7 ft. 6 in. by 3 ft. 3 in. The Montala Ironworks Company, of Sweden, sent two plates of 12 ft. by 2 ft. 6 in., and one 6 ft. by 3 ft. 8 in. All the plates were of 4½ in. thickness, and then bolted to a teak target backed with iron plating, and supported by a massive stone pier. The two upper plates in the target were the French, and each was secured by 11 bolts. The next plate below was the longest, Swedish, and this was secured by 29 bolts. Below this was a tier of two short plates, one Swedish and one English, each secured by 24 bolts, and the lowest place was a long English, secured, like the Swedish, by 29 bolts. Each plate received six shots from the ordinary 68-pounder naval gun. The French and Swedish plates broke to pieces, and the English plates remained uninjured and free from cracks. The shot used were of Swedish iron, and exhibited great toughness as compared with shot used in the English service—the core or centre of the shot, after striking, being of double the weight of the core of the English shot.

A number of rolled armour-plates of a new description have been received at Chatham Dockyard, supplied by Messrs. Chapman and Co. The new plates, specimens of which have been tested in the usual manner to ascertain their condition, are intended for the stern portion of the "Achilles." Already there are four kinds of plates on the exterior of the "Achilles," supplied by as many different firms. The broadside plates were manufactured at the Parkgate Ironworks, by Messrs.

Beale and Co.; those on the port and starboard bows, where they are required to be tapered to suit the form of the vessel, by Messrs. Brown and Co., of Sheffield; and a few of the plates manufactured for the Government by the Thames Ironworks Company have likewise been used as required. The only part of the "Achilles" which is not yet encased in armour is the stern, on which about twenty more plates are required to be fixed to complete the work. Owing, however, to the difficulty attending this operation, from the peculiar rounded shape of the stern, the work of plating this portion of the vessel will occupy a much greater time. The date fixed for launching, or rather undocking, the "Achilles" is the 26th of December.

The want of hands in the agricultural districts of France has caused a demand for light steam ploughs to supply the defficiency. Twelve of these ploughs have been ordered for the Imperial farms. They are of two to five-horse power, and cost from 2,000f. to 6,000f. They are fixed on four wheels, and are light enough to be removed from one field to another by a pair of horses.

At the last sitting of the French Academy of Sciences, a new apparatus for enabling persons to remain under water, or in places filled with deleterious gases, was described. The apparatus consists of a piece of wood having the form and dimensions of the human mouth when open. To this piece of wood two india-rubber tubes are fixed, of any length, according to the exigencies of the case. The man engaged in the operation is further provided with a nose pincher, or instrument for compressing the nostrils, so as to prevent the introduction of the deleterious gas or of water, as the case may be. The operator puts the piece of wood into his mouth, and puts on the nose pincher; he stops up one of the orifices with his tongue, and inhales pure air from the other; after which he shifts his tongue to the latter orifice, and exhales his breath through the other. He continues thus regularly shifting his tongue from one orifice to the other in the order of the inspirations and expirations; but even a mistake would be of little consequence.

The Royal factories at Woolwich have commenced manufacturing guns of the new kind ordered by the War Department. A number of the old hands, discharged some time ago, have been re-engaged, and the work is ordered to be carried on night and day to ensure despatch.

The turning up of a horseshoe, real iron, from a depth of seven metres in the diluvium of pre-Adamite deposit bids fair to put out of joint the famous Abbeville jawbone. The phenomenon has been found on railway excavation in the Orne Valley, between Caen and Condé. The *Journal du Calvados* gives ample details, adding that not only horse bones and sundry other antediluvian fauna, but skeletons of the Hudson's Bay beaver are plainly recognizable.

The great demand for Welsh coal which is at present experienced at the port of Cardiff, where some hundreds of vessels are at the present time waiting their "stem," has called some attention to its cause, and it has been found from the daily clearances at the Bill of Entry Office that an immense quantity is being cleared for Nassau and contiguous ports. The advantages of a smokeless coal have been quickly discovered by the Confederates and their friends, who, in order to run the blockade, have found it necessary to employ the fastest steamers instead of sailing vessels. It is well-known that Cardiff has supplied a considerable quantity of the coal consumed on board several of the notorious Confederate privateers, and there can be no doubt that a coal devoid of smoke being a great *desideratum*, the Welsh coal has been found the most suitable. From 30,000 tons to 40,000 tons of steam coal are now being shipped from the port of Cardiff monthly.

A very interesting trial trip of the jointed steamer "Connector" took place on Saturday, on which occasion Mr. Reed, Chief Constructor of the Navy; Admiral Belcher; Captain Symonds, R.N., and other nautical gentlemen, were present. The "Connector" started from Greenwich during the height of the gale on that day, and, notwithstanding the severity of the weather, proceeded with her distinguished party down the river, eliciting the admiration of all at the excellent manner she behaved in the gale. When in the neighbourhood of Gravesend she disconnected and reconnected her sections, notwithstanding the roughness of the water, with perfect success, and ultimately detached her steam portion, with the Chief Constructor of the Navy and naval officers of the party, and landed them at Purfleet. She then reconnected and steamed against the full force of the gale back to London.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

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834. G. S. GRIMSHAW. *Improvements in carding engines* Dated April 1, 1863.

In carrying out this invention, the inventor gives the roller, technically called the "licker-in," a differential speed, so that it will travel a greater space in a given time than the cylinder, by which he gains an economy in time by producing an increase of work more than can be done by the ordinary method, and also an improved quality. The proportion of the speed of the licker-in is about five and a third to one revolution of the cylinder. *Patent abandoned.*

835. J. HINDLE, W. F. CALVERT, and E. THORNTON. *Improvements in looms for weaving.* Dated April 1, 1863.

This invention relates to that portion of looms called the connecting rods or crank arms used for communicating motion from the crank shaft to the lay stay or batten, and consists in making each of the aforesaid rods or arms with an intermediate joint between the two joints connecting it with the crank and lay. The said intermediate joints are formed with partly squared ends or stops for holding the rods or arms perfectly rigid during the time the weft is being beaten up, but allow the joints to be turned when the crank has passed the centre for the return stroke, and thereby cause the arms to be thrown out of a straight line, and, consequently, shorten them to the extent of the angle that one portion bears to the other, thus bringing the lay back from the front to the bottom centre much quicker, and from the bottom to the back centre much slower than by the ordinary method, and allowing the picking motion to be brought into action considerably sooner than heretofore, and giving more time for the shuttle to pass and to a great extent easing the pick. 2, The improvements consist in causing levers, put in motion by the stop rod, to come in contact with a bracket on the crank arm, causing them to be thrown into an angular position, so as to allow the cranks to proceed without continuing the forward motion of the lay, and thereby avoiding the concussion and consequent wear and tear common to the ordinary loom, and also preventing the breakage of the yarn by the shuttle being caught or trapped in the shed. When the shuttle has to be delivered, the levers are pressed by the projections on the crank arms, and push back the swell fingers, and thereby relieve the shuttle in the box previous to the commencement of the pick, and they remain in the same position until the shuttle is boxed on the opposite side. *Patent completed.*

836. J. ROWLAND. *An improved mileage apparatus for measuring and registering the distances public vehicles or private carriages travel.* Dated April 1, 1863.

This invention is not described apart from the drawings. *Patent completed.*

837. J. BRAY. *Improvements in the construction of omnibuses, railway carriages, and other vehicles.* Dated April 1, 1863.

This invention is not described apart from the drawings. *Patent completed.*

838. M. HENRY. *An improved method of lubricating.* (A communication.) Dated April 1, 1863.

The patentee claims the employment or application of a cradle or frame, on or over which are carried or suspended cotton wicks, or other capillary conductors, in such manner that such wicks or conductors shall convey lubricating material from the reservoir or part containing it to the journal or other appliance or surface to be lubricated, as described. *Patent completed.*

839. W. CLARK. *Improvements in preventing fermentation in alcoholic and other liquids while drawing them from their containing vessels, and an apparatus for the same.* (A communication.) Dated April 1, 1863.

According to this invention, an apparatus is applied to the barrel or receiver communicating on the one hand with the receiver, and on the other with the external air. The apparatus contains a disoxygenating solution, arranged in such manner that the atmospheric air cannot enter the barrel without passing through the said solution, and giving up its oxygen thereto. In this manner, in place of the liquid drawn off at each time, there will be introduced an equal volume of azote, and although the azote may be in contact with a fermentable liquid, it will be incapable of fermentation when free from oxygen, as it is well known that oxygen gas is an essential element of fermentation. The disoxygenating solutions the patentee ordinarily employs consist of sulphate of lime and sulphite of protoxide of iron, either together or separately, and dissolved in water. *Patent completed.*

840. W. WEST. *Improvements in working railway signals.* Dated April 1, 1863.

This invention relates to the working of railway signals at a distance, and consists in the employment of a novel arrangement of self-adjusting apparatus, by means of which the expansion or contraction of the wire used for transmitting motion to the semaphore or other signal is compensated for, and the complete and rapid action of the signal ensured. In carrying out the invention, the patentee winds that part of the wire, chain, or cord nearest to the pull-over lever round a grooved wheel, and attaches it to the wheel at any given spot, carrying over the end of the wire, and suspending a weight from its extremity. The grooved wheel is free to move on its own axis, so that the weight will always keep a tension on the wire, chain, or cord. In order to work the signal, he rocks the wheel by means of the pull-over lever, which is provided with a self-acting clutch, so arranged as to grip the wheel when the lever is set in action, and rock the wheel, thereby putting such tension on the wire or chain as will ensure the change of the distant signal. *Patent completed.*

841. W. MITCHELL. *An improved process for coating iron.* (A communication.) Dated April 1, 1863.

This invention relates to a novel mode of coating articles of iron with protecting or lustrous metals, such as copper, gold, silver, nickel, zinc, tin, antimony, and bismuth, and their alloys. In depositing a layer of copper or a metallic alloy upon the surface of iron, the iron should be the best charcoal bloom, sound and free from blister, and of uniform temper. For making bronze iron for spikes, bars, braces, bands, or other appliances for ship-building, the iron should be good common sound iron. In preparing the iron for being rolled into sheets, care must be taken to obtain a surface free from indentation, caused by scales of oxide being forced into the plates of iron in the process of rolling. The oxide scale should be removed in time, so as to obtain a smooth surface similar to what is required for receiving a coat of tin. For more particular work, the iron should be rolled both ways to produce a cross fibre. The size of the plates when bronzed should always correspond to the size required when finishing, keeping in view the increase in length by rolling. For all other purposes the iron to receive the coat of metal should be prepared in the form and size required for use. *Patent completed.*

842. G. T. BOUSFIELD. *Improvements in steam boilers.* (A communication.) Dated April 1, 1863.

This invention consists in combining tubes through which the water passes, and which are in the furnace, with tubes through which the products of combustion pass, and which are surrounded with steam, or with steam and water, so that after the heat of combustion has partly spent itself in evaporating the water which passes through the water tubes, it will superheat or dry the saturated steam which is evolved from the water tubes, thereby commanding the highest evaporating power in the smallest compass, and with the greatest facilities for cleaning and repair. *Patent completed.*

843. E. B. WILSON. *Improvements in the manufacture of iron and steel, and other metals, and in the apparatus employed therein.* Dated April 1, 1863.

This invention consists in blowing into the cupola or melting furnace hydrogen gas, or a mixture of hydrogen gas with carbonic acid gas, obtained in any convenient manner, in conjunction with atmospheric air. The method adopted for the generation of the hydrogen and carbonic acid gases is to direct a blast of atmospherical r in conjunction with superheated steam through a separ at cupola or furnace containing fuel in a state of incandescence. From this cupola or furnace the gases so obtained, mixed with a certain amount of air so as to procure either a perfect or an imperfect combustion of the gases as desired, pass into the cupola or melting furnace, which is charged with the metal or ores to be reduced. The combined blast may be continued until the metal is refined. *Patent abandoned.*

844. A. GAVIN. *Improvements in the preservation of perishable liquids during the withdrawal or consumption thereof.* Dated April 1, 1863.

In the case of a cask or barrel being the holding receptacle of the liquid, the interior of such cask or barrel is made, according to the present invention, perfectly cylindrical. This cylinder is fitted with an accurately but loosely fitting disc, float, or diaphragm of wood or other material. When the cask is full of liquid, the disc or diaphragm floats or rests upon the surface of the contained liquid immediately beneath the cask head, and as the liquid is gradually withdrawn in the ordinary manner, the disc sinks with the descending level of the liquid. In this way, the liquid is kept entirely or nearly free from contact with the external atmosphere, as the cask is vertically kept always full of liquid. *Patent abandoned.*

845. W. H. PHILLIPS. *Improvements in means or apparatus for cleaning the bottoms of ships or other floating vessels.* Dated April 2, 1863.

For the purposes of this invention, the form of apparatus which the patentee prefers to employ consists of a circular frame or disc revolving freely upon a central axis, carried by a suitable framing or support, capable of being suspended from the deck (by one or more ropes or chains passing

around or underneath the vessel) and pressed against the bottom or side of the vessel to be cleaned when required. This framing may also be guided or stayed by chains or ropes passing fore and aft from it to either end of the ship, which chains or ropes may be used to give the brush a fore-and-aft movement, if desired, when in use. The surface of the frame or disc, which is thus pressed up against the bottom or side of the vessel, is of a brush-like character, composed of cane, whalebone, wire, or other elastic or yeilding materials, combined or otherwise with blades or rigid projections if desired. To the outer surface of the frame or disc is attached a self-acting revolving apparatus; but he prefers to use a series of vanes or blades which revolve as the vessel is propelled through the water, and which cause the apparatus mounted upon the axis to revolve by being connected to them by suitable gearing as the vessel so passes through the water; or they may be caused to rotate by the action of the tide when the vessel is stationary. The apparatus is capable of being shifted from one position to another by a crab, capstan, winch, or other means acting on the chains or ropes which support or suspend the apparatus. In place of attaching the brush or rubbing surface to the rotating disc by gearing, as above described, it may be separate therefrom, and have an oscillating or to-and-fro movement imparted thereto by means of a crank or other gearing connecting the revolving disc and the brush or cleaning instrument together; by this means a chipping or chopping-off action may be given to the cleaning instrument. When the vessel is in still water, motion may be communicated to the revolving brush or cleaning instrument by means of a driving band passing over a drum or pulley on the axis of the series of vanes or blades actuating the revolving disc to another drum or pulley mounted upon and driven from the deck of the vessel, or from a raft, barge, or other floating body lying alongside the vessel. The rotating brush or cleaning surface may be formed around the circumference of a drum having a central axis, to which rotary motion may be given by similar means to those previously described. *Patent completed.*

846. J. W. LAW and J. INGLIS. *Improvements in making moulds for casting, and in apparatus connected therewith.* Dated April 2, 1863.

This invention is not described apart from the drawings. *Patent completed.*

847. E. F. CLARKE. *Improvements in the means of fastening rails for railways.* Dated April 2, 1863.

This invention relates to the construction of the chairs and keys employed to support and fasten the rails to the sleepers on railways, and also to the method of fixing and securing the same. The chair is formed with a vertical slot tapering downwards, and which is cut or formed in the inner faces of the chair, and extends through the bottom of the same. The keys are each formed with a head which fits on the side of the rail, and drops into a recess formed in the chair for that purpose; a vertical pin from the outside, and extending downwards in such a form that, when the keys are placed one on each side of the rail, the pins meet underneath; and on being dropped vertically (in this position) into the chair, the pins exactly fit and completely fill the taper vertical slot in the chair. The heads of the keys are the same width as the chair, except at the joint chairs, where they are made wider, so as to act as fish plates. In order to keep the keys and rail in their position, and to prevent the rail from rising, the patentee drills or forms a hole longitudinally (in the direction of the rails) through the chair beneath the rail, and forms a corresponding hole through the ribs of the keys (half in each) at the point where they meet under the rail, and he drives a pin through the chair and the keys, and thus secures the whole firmly together. The chair is fastened to the sleeper in the ordinary manner. *Patent completed.*

848. D. S. SUTHERLAND. *Improvements in protecting vessels of war and fortifications from the effects of projectiles.* Dated April 2, 1863.

Sand, when securely confined within boundaries which prevent its escape from a pressure applied to it, is practically incompressible, and from the mobility of the particles composing it, is capable of transmitting and distributing a pressure or blow given to any part of a mass so confined over the whole or greater part of such mass. These properties of sand may with great advantage be employed in combination with armour plating as a means of protecting surfaces from the effects of projectiles. The arrangements employed for these purposes may be greatly varied. *Patent completed.*

849. J. CASSELL. *Improvements in stills for the distillation of petroleum and other heavy oils.* Dated April 2, 1863.

This invention is not described apart from the drawings. *Patent completed.*

850. J. J. PÜTEL. *Improvements in furnaces and fireplaces having for object the consumption or prevention of smoke.* Dated April 2, 1863.

This invention is applicable to fireplaces of all kinds, whether for furnaces, domestic stoves, or others. The invention consists in constructing fireplaces and furnaces with no outlet for the products of combustion except through apertures made at an angle of 45 degrees, more or less, in a bridge or wall at the back of the fireplace. The gases evolved from the coal or other fuel used, mixed with atmospheric air, pass through or over the incandescent fuel, then through the apertures in the bridge. The gases pass through these apertures in a state of flame, and are used for heating purposes at the back of the bridge. *Patent completed.*

851. W. JONES. *Improvements in the construction of ships or vessels, part of which improvements are also applicable for constructing buildings and for various other purposes in which rolled iron is employed.* Dated April 2, 1863.

This invention relates mainly to rolling bar or angle iron with shoulders or recesses against or in which corresponding parts of a contiguous bar will fit and add greatly to the strength, rigidity, and stiffness of the structure. For many parts of iron ships the iron is to be rolled with a recessed shoulder against which the edge of the contiguous plate will butt, and thereby offer a considerably greater resistance to end-pressure than when a joint simply depends on the rivets. *Patent abandoned.*

852. G. A. COX. *Improvements in the treatment or preparation and manufacture of jute, hemp, flax, and other fibrous or textile materials.* Dated April 2, 1863.

This invention relates to the arrangement and construction of various mechanical contrivances to be used for snipping, teasing, hackling, cutting, breaking, and otherwise treating as a part process of the manufacture thereof, jute, hemp, flax, and other fibrous or textile materials, such operations being anterior to those relating to the spinning and final manufacture into fabrics of the fibrous or textile materials hereinbefore referred to. According to one modification of the machinery or apparatus involved in carrying out the present invention, the contrivance for holding or gripping the jute, hemp, flax, or other fibrous material, consists of two endless grippers or holding sheets, made of hemp or other fibrous material, gutta percha, caoutchouc, leather, chain, wire, or other flexible substance. These grippers or holders work over grooved or plain pulleys or carrying rollers, one being situated at each end of the loop or bend of the grippers which operate in a horizontal direction. These traversing grippers are disposed in an open frame which carries the bearings for the pulleys, one gripper being directly above the other, the two being set to work parallel with each other and in contact. The lower endless gripper is made considerably longer than the upper one in order that a space may be left at each end of the longer one to act respectively as feeding in and delivering tables. Both the upper and lower grippers traverse continuously in the same direction; and if a firmer hold upon the fibre is required, that effect can be secured by adjusting the levels of the roller centres closer to each other, the projections of one coinciding with the grooves or recesses of the other. Immediately above and beneath the point where the hackle or gill of the cylinders, travelling gill sheet, or combs work upon the fibre for the opening or disintegrating process, there are disposed curved plates or other fixtures to afford the grippers or holders a superior strain or more powerful hold upon the fibre. There are also adjustable rests placed in front of the holders or grippers to give the necessary length of nip or holding pressure. Parallel to the travelling grippers or holders, so far as snipping, teasing, combing, or hackling are concerned, there is disposed a cylinder or cylinders, or revolving sheet, or combing arm, running either with or against the direction of traverse of the fibre, as may be necessary, these details being fitted with hackle pins, gill pins, or whatever pointed or blunt instruments may be necessary for the further treatment of the fibre. As the fibre is fed into the gripper or holder, the attendant allows the end of the fibrous mass to hang over the edge to the extent to which it is intended to be hackled, snipped, teased, or combed; it is carried along by the lower gripper until it is conveyed between it and the upper gripper. Here it is secured and carried along over the face of the cylinders where the operations of hackling, snipping, teasing, and combing are accomplished. *Patent completed.*

853. A. P. PRICE. *Improvements in apparatus employed in the fusion, manufacture, production, and refining of metals.* Dated April 2, 1863.

This invention consists in so constructing cupolas, blast furnaces, or other similar furnaces employed for the manufacture, fusion, or production of cast iron, steel, or other metals, and crucibles, or other similar vessels employed in the conversion or refining of cast iron, in the manufacture and production of iron or steel by the injection of air or gases, or by that process known as the atmospheric process, that they shall be surrounded either entirely or partially with a hollow casing of cast iron, or of malleable iron, or other suitable metal, and shall be so constructed that a current of water or jet of steam, or a blast of air may circulate freely through and around such hollow casing, by which means the sides of the cupola, blast furnace, crucible, or other similar converting vessel may be cooled, and the lining of the cupola, blast furnace, crucible, or other similar converting vessel may be preserved from the destructive action of the heat and the fluxes. When this casing is applied to crucibles or converting vessels used in the conversion of cast iron into steel or iron, and require to be moveable, the patentee prefers to construct the casing in such a manner that it shall be closed with the exception of suitable inlet and outlet pipes, so that no water, steam, or air shall escape except by such outlets when the vessel is moved for the purpose of discharging its contents. The inner surface of the casing may be lined with fire-brick or fire-clay, or any other suitable material. *Patent completed.*

854. A. B. SKITHEN. *Improvements in casings, covers, or wrappers for bottles, jars, and other articles.* Dated April 2, 1863.

Instead of making the wrapper so as to cover the top or neck of the bottle or other article, as hitherto practised, the patentee leaves the wrapper open at the top, so as to allow the whole or part of the neck of the bottle or other article to project beyond the wrapper, whereby considerable economy is effected in the quantity of the material of which the wrappers are made, and other advantages are obtained in the packing, storing, and handling of the bottles or other articles. He makes these wrappers or covers of rushes, or of straw, or of any other suitable vegetable substance or material; and if formed of machine straw, or of hay, or other broken or short-fibred substance, he converts the same into strands, lines, or ropes tied spirally or otherwise with twine or string. He arranges the rushes or other substance, or the strands, lines, or ropes made of the same, round a form corresponding with the shape and size of the bottle or other article for which the cover may be intended; or he winds the strand, rope, or line spirally round the former, and he then sews by hand or machinery, or ties or otherwise binds or secures the strands, layers, or ropes together; or he first forms the material into mats sewn by hand, or by machinery, or otherwise tied or secured, and subsequently converts the said mats into covers or wrappers. When the material of which the wrappers are to be made is so sewn or stitched by machinery, the said material is spread or ranged upon strips or pieces of paper, calico, or other woven fabric to facilitate the forming of the stitches. *Patent completed.*

855. A. STEWART. *Improvements in saddles.* Dated April 4, 1863.

Instead of fixing the saddle in the usual permanent way to the saddle tree, it is, according to this invention, contrived so as to be connected thereto or disconnected therefrom at pleasure, and it can in consequence be conveniently stuffed in a more uniform manner, and to a greater depth when required for horses with high backbones, whilst there is not the increased hardness at the after part, which is unavoidable with the mode of fixing hitherto adopted. For the purpose of attaching the pannel to the saddle tree, the former has fixed in it near its outer edge at suitable points certain metal sockets or nuts screwed to receive thumb screws, which are inserted from the upper side of the saddle through eye-plates fixed into the saddle tree. The screws are by preference formed with slotted thumb heads for turning them by, and two of these which are at the front part of the saddle serve to receive cloak straps, and dispense with separate staples for that purpose. At the crupper a metal staple is fixed into the pannel, and a screw is passed through an eye in this staple, and is screwed into a socket or nut firmly fixed into the back of the saddle tree. The back of the saddle tree is by preference shaped squarely down, instead of being acutely bevelled off, as in most British saddles; and this facilitates the application of the staple and screw, and permits of the bearing surface upon the horse's back being comparatively larger for a given size of seat. When a crupper strap is used, the crupper screw is formed with a slotted thumb head through which the strap is inserted; a separate staple may, however, be fixed to the back of the saddle for the crupper strap. *Patent abandoned.*

856. J. BLAIR. *Improvements in the finish of threads and yarns.* Dated April 4, 1863.

In carrying out this invention, the patentee makes a compound or mixture similar to soft soap from any of the fixed fatty oils, such as olive, palm, or similar substances, the same to be saponified by being boiled with a metallic oxide, such as caustic potash, and also salt. To this mixture or compound may be added spermaceti, lard, white wax, paraffin, or similar articles, to give additional softness to the yarn or thread. For fine yarns the proportions used are—oil and caustic potash and salt about 90 parts, lard and white wax 10 parts; for coarse yarns—80 parts of soft soap and salt, and of white wax, olive oil, lard, &c., 20 parts; in each case to be diluted with water, say about three-fourths to one gallon to each pound weight of the mixture, as experience may find best. The rove, when being spun, must be passed through the said mixture whilst in a warm or dissolved state (which can be accomplished by steam or other similar means, but a steam bath is preferred), and reeled at once (without being dried by a stove), and then placed on a stretching machine, and after about fifteen or twenty minutes' gentle pinning the yarn will be ready for use in the loom without boiling or dressing. Yarn for linen thread must be twisted through the mixture the same as yarns for weaving, and finished in the usual way; but threads for sewing machines should be passed through the mixture (after being twisted and dyed) in a cold state for at least twice, and then remain in the polishing machine for about ten minutes or so. *Patent completed.*

857. P. HANREZ. *Improved machinery or apparatus for drying coal, grain, and other substances.* Dated April 4, 1863.

This improved machinery or apparatus consists of a central shaft or axis mounted in a step or socket in such a manner as to allow of a sufficiently rapid motion being imparted thereto to throw off, by the effect of centrifugal force, the water contained in the coal or other matters under treatment. On this shaft is fixed a circular ring or crown, to which is attached a frame covered with wire cloth, or perforated sheet metal, the holes being of such diameter that the water will escape through the same while the coal or other matters are retained. The water which escapes through the casing is projected against an outer casing of sheet iron, which surrounds the apparatus, and which throws it down into a reservoir, from which it is let off by a cock. Concentrically with the aforesaid shaft is fixed a hollow shaft which turns rapidly in the same direction as the former (or inner shaft), but with a different velocity. This hollow shaft serves as the axis to a spiral screw or helix, of which the exterior diameter is equal to that of the interior of the perforated cylinder. This screw, turning as aforesaid with a different velocity, lesser or greater than that of the drum or cylinder, the coal or other matters being continually fed into the apparatus by means of a hopper, will fall first on to the top thread of the screw, which is slightly curved upwards or flanged in order to collect or throw over the matters more quickly. By the rapid rotation of the aforesaid screw, the coal or other matters are thrown against the sides of the drum, down which they fall vertically while being deprived of their moisture, and reach the bottom dry, falling into a reservoir adapted for the purpose of receiving them. The rapidity of the descent of the matters fed into the drum along its sides will be proportionate to the difference between the rate of rotation of the drum and that of the screw, and the pitch of the screw being determined, this difference may be determined so as to ensure the coal or other matters remaining in the apparatus until perfectly dry. *Patent completed.*

858. J. SILVESTER. *Improvements in attaching guards to pressure gauges.* Dated April 4, 1863.

This invention consists in making the guard in one piece with the rim, by which the glass plate is held in its place in front of the dial plate, the rim and guard being made

in one piece either by casting or stamping. Or the rim and guard may be made in separate pieces, and joined together by soldering, screwing, rivetting, or otherwise. Or the guard may be made separate from the rim, but of such a size that it will fall into or enter the said rim. In this case two pins or screws are inserted in a radial direction in the rim, and opposite each other, and a notch is made in the edge of the guard. By inserting the edge of the guard under one of the said pins or screws, and causing the notched part of the edge to pass the other pin or screw, the guard may be brought underneath the said pins or screws. By now turning the guard until the notch in its edge is not opposite either of the pins or screws, the guard is securely fixed in its place. By this last described improvement the guard may be readily removed for the cleaning of the glass. Or the guard may be placed on the front of the rim and secured thereto by screws. *Patent abandoned.*

859. W. H. Perkin. *Improvements in the manufacture of red and orange colouring matters.* Dated April 4, 1863.

It has before been proposed to act on a salt of napthalamine with nitrate or potash, or other nitrate, so as to obtain a red or orange colouring matter; but the process has been of no commercial value, as the reaction when these two substances only are employed is incomplete and variable, besides which the proper purification of the colour has not heretofore been effected. According to this invention, the inventor employs, in addition to the salt of napthalamine and the nitrate, an alkali or basic substance, capable of taking some of the acid from the salt of napthalamine. He employs in practice the hydrochlorate of napthalamine, nitrate of potash, and potash; and to two equivalents of the first he adds one equivalent of each of the latter; immediately chloride of potassium is formed, and one equivalent of nitrous acid is left to act on two equivalents of napthalamine, the required colouring matter is precipitated, and it may at once be used as a pigment for printing, or it may be dissolved in alcohol and used as a dye. The colour, however, is much improved by purification, which is effected by washing it with water, then dissolving it in alcohol or other solvent, and crystallizing it out therefrom. To produce the purified pigment, the inventor precipitates a solution of the purified colour by means of water. *Patent abandoned.*

860. W. E. Gedge. *Improved apparatus for bolting flour.* Dated April 4, 1863.

This apparatus is composed of the ordinary bolter, covered with its cloth, with the addition of a wire gauze cylinder within it. On leaving the mill the undressed flour is received in the cylinder or inner bolter, which permits the flour to pass through its web, but retains both the fine and the coarse bran when they arrive stripped of flour at the opposite extremity of the cylinder. The flour which arrives alone in the second bolter is then bolted more regularly, and deposits a large quantity in the compartment reserved for the first. *Patent abandoned.*

861. G. Gimson. *Improvements in the means of actuating shuttles in looms for weaving narrow fabrics.* Dated April 4, 1863.

This invention relates to the means of traversing the shuttles through the sheds in the act of weaving narrow fabrics, in which process it is well understood several widths of fabrics are arranged side by side, and woven simultaneously, the several shuttles being mounted on a batten, and motion communicated by means of pegs entering and leaving the shuttles on each side of the warp, or by other means. These improved means consist in the application of a screw, or a series of screws, on the same shaft, one for each shuttle. The thread of such screw is of rapid pitch, and takes directly into the shuttles, sections of screws being cut therein for the reception of the thread. The screw shaft is rotated, first in one direction and then in the other, whereby the shuttles are propelled to and fro through the sheds formed in the warps, a shuttle being transferred from a screw on one side of the warp to the other screw on the other side. All the shuttles move in one direction at the same time, whereby, on one shuttle leaving a screw, it makes room for another shuttle coming or belonging to the adjoining warp. *Patent abandoned.*

862. A. V. Newton. *An improved construction of pressure gauge.* (A communication.) Dated April 4, 1863.

This invention applies, mainly, to the construction of gauges for gauging steam or water under high pressures. In carrying out the invention, a disc or plate of iron, or other suitable metal, is provided, having a recess or chamber for mercury on its under side, and pierced with a central opening for the passage of the mercury in its upward or downward movement. Fitted into a central recess of the disc is a cylinder of india rubber, which forms a bearing for a glass tube. Secured to the metal disc, and covering the same, is a cap having a shoulder for supporting a metal tube which surrounds the glass tube. A slot is made through the whole length of the metal tube, in order to show the height of the mercury in the glass tube, the same being indicated by a graduated scale. A metal cap, having a central opening is screwed to the metal tube, and serves to hold the glass tube in its place. A lateral hole is made in the metal disc for the insertion of mercury into the chamber below it. This hole, when the chamber is filled, is closed by a screw. A cylindrical cup is clamped to the under side of the central disc, and a diaphragm of india rubber is placed between it and the disc. A metallic plunger plays loosely in the upper and lower sections of the cup. The area of the upper portion of the plunger being much greater than that of the lower portion, allows of the mercury column being shortened. The downward movement of the plunger is limited by a shoulder in the cup. Attached to the under side of the cup is a coupling for admitting steam or water to act on the plunger. Between the cup and coupling is a diaphragm of india rubber, forming a tight joint, and on the upper surface of which rests the bottom of the plunger. The steam or water admitted to the gauge presses forcibly upon the lower part of the plunger, thereby forcing the mercury upwards in the glass tube in proportion to the pressure applied. As many times as the area of the lower end of the plunger is less than the area of the upper end of the plunger, so many times less will be the pressure per square inch upon the area of the upper portion of the plunger than upon the lower portion of the same plunger, thereby rendering practicable the employment of short columns of mercury for the measurement of high pressures without any other opposing medium. *Patent abandoned.*

863. P. Spence. *Improvements in the manufacture of sulphuric acid and sulphate of iron.* Dated April 4, 1863.

This invention has for its object the saving of the waste vapours arising from the manufacture of sulphuric acid, and the production by such saving of sulphate of iron. To effect these improvements the inventor causes the waste vapours to pass through masses of metallic iron in the condition of porous cakes, whereby the said gases are absorbed, and sulphate of iron is consequently produced. The condition of metallic iron above referred to is attained by submitting its oxides or ores to heat, so as to reduce it without fusion. The finely divided metal which arises from this treatment, he also proposes to use for the manufacture of sulphate of iron, apart from the manufacture of sulphuric acid. *Patent abandoned.*

864. F. O. Bakewell. *Improvements in wicks for lamps.* (A communication.) Dated April 6, 1863.

The patentee claims—1, the construction of a hollow tubular lamp wick, having an internally napped surface to increase the capillary action, substantially as described; 2, making a hollow wick for lamps of a folded strip of muslin, or other textile fabric, by uniting the edges together with a paste or cement insoluble in the oil or other fluid to be consumed; 3, making hollow or tubular lamp wicks of muslin, linen, or other suitable material, with or without a nap on the inner surface, with a filling of cotton, wool, bibulous paper, paper pulp, or other substance possessing the requisite degree of capillarity, as described. *Patent completed.*

865. B. Cooper. *Improved apparatus for feeding scribbling or carding engines.* Dated April 6, 1863.

This invention is not described apart from the drawings. *Patent completed.*

866. T. Burrow. *Improvements in, and machinery for, combing or dressing silk, flax, wool, hemp, China grass, or other fibrous materials.* Dated April 6, 1863.

This invention relates to improvements in machinery for combing, or dressing silk, flax, wool, hemp, China grass, or other fibrous materials, and consists in the employment of two revolving combs, which comb both ends of the fibre before it leaves the machine. *Patent abandoned.*

867. W. E. Gedge. *Improvements in aerial machines.* (A communication.) Dated April 6, 1863.

According to this invention the car acts as ballast, and holds the balloon in an almost horizontal position. It contains a steam boiler, water, coal, and the apparatus required for the aerial voyage. A rope ladder furnishes the means of ascending to the fore part of the balloon, and at the same time holds the fore part of the car suspended to the fore part of the balloon. From the fore part of the car a capstan or windlass may be turned on, which enrols the lower part of this ladder, shortening or lengthening it so as to make the car weigh down the balloon more or less to the front or rear, accordingly as it is desired to ascend or descend. In front of the balloon is a small case serving to maintain the bearing. The rear or stern part of the car is suspended to the stern of the balloon by a pipe of aluminium, which conducts the steam to a machine fixed to the same piece as the bearing at the stern of the balloon. The piston of this machine communicates directly with a connecting rod fixed to a shaft which traverses the balloon in its entire length. This machine acts on the connecting rod, and causes the shaft and the entire balloon to turn. Another rope ladder leads from the car to a case near the machine, and another capstan or lever holding the two ends of the rudder cords at the stern of the car permits oblique divergence to the right or left. The body of the balloon is of ovoid form; the smaller end passes first, and the larger end, having greater ascensional power, supports the bearing fixed to the machine, the rudder, and the oblique sails. These sails should present a surface of at least twice the thickness of the balloon, so that in turning they will press upon twice as much air as will oppose the end of the balloon. These sails, however numerous, may be all closed simultaneously by pulling a rope from the car during the progress of the balloon, and, on pulling another rope, the catch which holds the sails closed falls, and they open of themselves under the pressure of the wind. The object of this arrangement is to change the speed without interfering with the steam, as the balloon itself acts as a flyer, and it is desirable not to interfere with its regular march. Presuming that these sails when fully opened describe a course of twenty yards, it will follow that every stroke of the balance beam will drive the entire aerial apparatus twenty yards forward. The balloon may also be constructed entirely in the shape of a screw with the above arrangement. *Patent abandoned.*

868. M. Henry. *Improvements in probes, catheters, and similar surgical instruments.* (A communication.) Dated April 6, 1863.

According to this invention, it is proposed to manufacture probes, catheters, and similar instruments of vulcanized caoutchouc, instead of the materials usually employed. Also, according to this invention, probes, catheters, and like instruments may be constructed in such manner that they may penetrate to the part required without the aid of a mandril, or other rigid instrument, and yet be sufficiently flexible to pass suitably through the person. For this purpose the instrument may be made sufficiently flexible in the body, but terminate in a stiffer and tapering or more slender end at the entering extremity. An improved catheter or instrument may be constructed of a piece of vulcanized caoutchouc, or like substance, made tubular, or with a passage in it, such piece being of considerable thickness of material, or with thick sides comparatively to the bore of the passage, and terminating at the end to be introduced into the person in a solid portion, which may be tapering, conical, or thinner towards the extremity. According to this invention, the outer end or mouth of catheters or similar instruments may be of a conical or bell-mouth form, and fitted with a vulcanized caoutchouc or other elastic stopper, attached to the instrument by a cord or like connection to keep it from being lost. The instrument may be prevented from entering too far into the person by attaching to it a sheath or stall, which is fitted on the penis or other part, and kept there by lacing or otherwise. *Patent abandoned.*

869. J. Railton and H. Booth. *Improvements in machinery for carding cotton and other fibrous substances.* Dated April 6, 1863.

The object of this invention is to keep the surface of the main cylinder of carding engines clean while at work, and to obviate the necessity of stopping the engine occasionally for the purpose of stripping the main cylinder. In performing this invention, the inventors apply a fancy roller to the main cylinder, which fancy roller is covered with straight card teeth or needle points radiating from the centre. The surface of the fancy roller runs at a greater speed than the surface of the main cylinder; consequently, the action of the fancy roller looms the fibres on the main cylinder, so that when the fibres are carried forward to the top flats or worker and clearing rollers, they are in a fit state for being carded, and then deposited on the doffer. *Patent abandoned.*

870. J. Burwin. *Improvements in pickers, and in the means or apparatus employed in the manufacture thereof.* Dated April 6, 1863.

This invention relates to pickers made of sizing or prepared animal hides, which heretofore have been made with sharp angles, on account of the method adopted in their manufacture, and which sharp angles are very objectionable in use, as they cut the straps and catch the weft, which is thereby damaged. These improvements consist in rounding or removing these sharp angles, which is effected by means of dies or moulds properly formed, into which the pickers are placed, and pressure applied thereto by lever, screw, or other suitable means of applying pressure. The apparatus employed cannot be described without reference to the drawings. *Patent completed.*

871. E. T. Hughes. *Improvements in machinery or apparatus for manufacturing the ornamental tips of parasols, umbrellas, and other similar articles.* (A communication.) Dated April 6, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

872. J. Swinburne and J. Stanley. *Improvements in steam engines and generators.* Dated April 7, 1863.

The first of these improvements provides a new mode o actuating the slide valve of steam engines, giving thereto a differential movement, and the power of reversing very similar in effect to that of the link motion hitherto in extensive use. The arrangement for carrying out this, is to fit an annular shaft or tube upon the crank shaft or axle of any steam engine (or upon another shaft that takes motion therefrom), loose to move without the shaft a limited distance in a rotating direction only, such annular shaft having two trunnions or pivots opposite to each other, so arranged as to form an axis for and to carry a sort of gimbal or annular disc. The gimbal or disc so carried is rendered capable of being set in any required position, and there held by means of a connecting link, one end of which is attached to the gimbal near the periphery about midway between the pivots, and the other end attached to a gland or sheave free to move (longitudinally only) upon the annular shaft by means of a forked lever or guide taking into a groove or clasping the gland or sheave. By this arrangement the gimbal can be set either to run true with the shaft, or take a wabbling to-and-fro motion in the direction of the axle line. This wabbling to-and-fro motion is made to give motion to the slide valve through the medium of a sort of bell crank and connecting rod, or by any other convenient means. When the gimbal is set at right-angles with the main axle line, the slide valve will be at rest; and when it is set at an oblique angle one way, the valve will move right for forward action, and when set the contrary way for backward. The limited rotary motion allowed to the annular shaft gives the required lead to the valve by means of a segment of a spur wheel taking into and passing out of a spur wheel fitted tight upon the annular shaft, or to the gland or sheave. In the latter case, the spur segment is of greater width to allow the movement of the sheave without missing the gear. Another method is to place the pivots that carry the gimbal at an oblique angle with the axle line, so as to give the short travel to the slide valve when the face of the gimbal transverse to its axis is set at right angles with the main axle line, as is obtained by setting the die in the centre of the link in ordinary use. In this case, the exact movement produced by the link motion is obtained without giving the lead by moving the annular shaft as described. *Patent completed.*

873. H. Gilbee. *A new composition for dressing and preparing silk, cotton, and woollen tissues and fibres, and also mixtures of the same.* (A communication.) Dated April 7, 1863.

This invention consists of a new industrial product composed of the following materials—1, Brazilian tapioca; 2, fig juice; 3, pearl moss; 4, vulcanized caoutchouc; 5, the juice of mulberry leaves. This composition can be applied to dressing and preparing all kinds of tissues made of silk, wool, or cotton, and of mixtures of these substances. It can also be applied to facilitating the winding of all fibres which have to be spun, wound, or twisted. *Patent abandoned.*

874. A. C. Bamlett. *Improvements in reaping and mowing machines.* Dated April 7, 1863.

The first part of these improvements relates to such reaping and mowing machines as have the pole to which

the horses are attached fixed to the machine by a universal joint, being designed to facilitate turning at the corners of the field, and to prevent accidents, and consists in controlling the movement of the pole by means of chains or projections fixed on the pole and fore part of the frame, so as only to allow the pole to turn to about right angles with the frame of the machine, or about parallel to the cutter bar. 2, In order to alter the "pitch" of the ordinary platform commonly known as Hussey's, the patentee mounts it in a frame which is jointed near the front edge of the platform. The frame is acted on by cranks, levers, or their equivalents, and by these means the pitch of the platform can be varied as required. *Patent completed.*

875. J. Macintyre. *Improvements in the manufacture of knobs, and other articles in china and earthenware.* Dated April 7, 1863.

This invention consists in giving an oval form to such knobs or other articles by turning after they have been formed by throwing, or otherwise; and for the purpose of turning such articles, the patentee employs a lathe provided with a chuck capable of producing ovals of various proportions, and of readily changing from such chuck to the circular chuck when producing circular stems or other parts to such description of knobs or other articles. And in order that the articles produced may be of uniform size and shape he prefers to employ tools, the cutting edges of which are suitably formed to produce the shapes desired, such tools being supported by guides and working up to a stop as heretofore practised when turning certain descriptions of circular articles. The invention also consists in producing balls, handles, grips, hat pins, and other similar articles suitable for door furniture, and other like uses, of a reeded, fluted, or other ornamental form, by turning. For this purpose he employs a template of the form desired, mounted upon one end of the spindle of the lathe head. This spindle at the end upon which the template is mounted is supported by an arm capable of movement upon an axis of motion, and the template is borne up to a pulley or follower fixed to the framing of the lathe by a string or other suitable means; the template can be thrown out of action when it is desired to employ the lathe for producing ordinary circular work. *Patent completed.*

876. J. H. Johnson. *Improvements in machinery or apparatus for drying grain, applicable also to the manufacture of malt.* (A communication.) Dated April 7, 1863.

According to this invention, it is proposed to employ a revolving screen of fine wire work, perforated metal plates, or other suitable material, and of any length and section, but strengthened by means of longitudinal external rods and transverse rings or annular frames at the ends and middle of the screen. This screen is provided with internal spiral blades, and with a hollow trunnion, through which latter the grain to be dried or desiccated is allowed to enter the revolving screen from a stationary hopper provided with a regulating slide. Beneath this screen—which is enclosed on all sides by a metal casing—there is a small stove from which pipes or flues conduct the heat to a chimney, after first traversing to and fro beneath the screen, so as to disperse the heat uniformly under the grain. This stove and pipes are protected by a shield or covering which prevents any particles of dust or refuse grain from depositing upon the stove and pipes. The refuse grain and dust are caught by an endless travelling band beneath the screen, and carried away to a spout, a revolving brush being employed for removing thoroughly the dust from the band or belt. Metal conductors are placed above the band to conduct the dust and refuse on to it as they fall from the screen. The grain is agitated by the revolution of the screen, and the heated air passing through it carries off the moisture and escapes with it by a hood or cowl at the top of the outer casing. The dried grain escapes from one end of the screen, which may be provided with regulating doors for that purpose, or left quite open, and falls into a lateral conducting spout. *Patent abandoned.*

877. J. H. Johnson. *Improvements in polishing precious and other hard stones, and in the machinery or apparatus employed therein.* (A communication.) Dated April 7, 1863.

This invention consists, essentially, in polishing the above-named substances without the intervention of polishing powders or substances of any kind between the wheel and the stone under treatment. The polishing wheel is composed of fine grit stone, and the dust produced is removed from the stone by a ventilator or brush, slightly wetted, being occasionally applied to the wheel for the purpose of preventing it from overheating. *Patent abandoned.*

878. R. A. Brooman. *Improvements in the manufacture of baryta and its derivatives, in obtaining by-products, and in revivifying or recovering certain agents employed in such manufacture.* (A communication.) Dated April 7, 1863.

The details of this invention are too voluminous to be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

879. R. A. Brooman. *Improvements in reproducing or obtaining fac-similes of the veins, pores, knots, and figures of wood upon paper and other surfaces.* (A communication.) Dated April 7, 1863.

This invention consists in covering a smooth plank or piece of wood with a coating of paint, which is made to penetrate the pores and veins thereof; in the removing with a scraper or otherwise all the paint remaining upon the smooth surface of the wood, leaving only such of the paint as has penetrated the pores and veins; in coating a very thin plate of copper or other metal on both sides with a thin layer of wax; and in applying this metal plate upon the wood prepared as before described. The metal plate is pressed strongly upon the wood by a roller or otherwise, and the paint is thus forced from the pores or veins of the wood and adheres to the wax upon the metal plate. The plate is then removed from the wood, and all the parts of the wax to which the paint has adhered are carefully scratched off with a sharp-pointed instrument, so as to expose the metal beneath those parts. The plate is next plunged into a bath containing nitric acid or aquafortis; the acid enters all the parts from which the wax has been removed, and bites through them. All the pores and veins of the wood are thus reproduced by the spaces bitten out of the metallic plate. The plate is washed with water to cleanse it, and the wax is removed by a bath of essence of turpentine or other spirit. The metal plate thus prepared serves for the reproduction of the veins, pores, knots, and figures of wood upon any surface, whether previously prepared by oil, paint, or otherwise. For instance, the plate is applied upon a surface painted with a ground colour, and a brush charged with paint of the colour of natural veins and knots is passed over the plate; the paint passes through the spaces or openings in the plate and adheres to the surface beneath such spaces or openings only, and thus an exact copy of the veins, pores, knots, and figures of the wood is obtained. *Patent completed.*

880. J. Howard, E. T. Bousfield, and J. Pinney. *Improvements in steam engines and in the means of applying the same to the tilling of land, also in apparatus to be used with such engines in the tilling of land.* Dated April 7, 1863.

This invention is not described apart from the drawings. *Patent completed.*

881. A. V. Newton. *Improvements in projectiles for ordnance and in fusees therefor.* (A communication.) Dated April 7, 1863.

The first part of this invention relates to the employment of fulminates of silver and mercury, and other fulminating compounds, for the bursting charges of explosive projectiles, its object being to obviate the accidental explosion of such charges in the handling or transportation of, or by the dropping of, the projectiles. To this end it consists in the use—either mixed with the fulminate, or interposed between small quantities of the fulminate so employed—of cotton, gun cotton, curled hair, wool, flocks, saw dust, or other soft fibrous or granular substance, to reduce the force of the concussion between the grains of the fulminate; also in lining the charge chamber of the projectile with woollen, cotton, or other cloth or flannel, or other soft material for the same purpose; also in the division of the charge into a number of parts by means of rigid partitions in the chamber, whereby the force of the concussion produced between the particles of fulminate, in case of dropping the projectile or subjecting it to severe concussion, is reduced. The second part of the invention relates to the use of metallic packing for the prevention or reduction of the windage between the projectile and the bore of rifled ordnance, and for obtaining a rotary motion of the projectile in its passage through the bore; and it consists in an improved arrangement of a flanged follower, in combination with an expanding, concave, convex, or conical packing ring. The third part of the invention relates to percussion fusees for the ignition of the bursting charges of explosive projectiles, and consists, principally, in the construction of a percussion fuse tube or plug with two separate chambers, one to contain fulminate of silver or mercury, or other fulminating powder, and another to contain sand, emery, broken glass, or any other hard granular substances, the chambers being so arranged and combined (by means of a lock of simple construction) as to be perfectly closed and locked to prevent communication between them until the firing of the charge of the piece of ordnance from which the projectile is to be thrown. The unlocking is effected by the impact produced upon the projectile by the explosion of the charge, and thus communication between the two chambers is opened for the admixture of their contents. *Patent completed.*

882. G. and W. R. Hill. *Improvements in steam boilers.* Dated April 8, 1863.

This invention consists in forming in the internal flues of steam boilers one or more water-tight compartments, which act as stays, and also provide additional heating surface. *Patent abandoned.*

883. W. Simpson. *Improvements in insulating the magnetic needle or needles in compasses.* Dated April 8, 1863.

This invention relates to all magnetic needles used in mariners', azimuth, and other compasses, and has for its object the insulation of such magnetic needles that they will practically be insensible to or uninfluenced by local attraction. *Patent abandoned.*

884. J. Moshkimer. *Certain improvements in machinery or apparatus for crushing, grinding, and dressing metallic ores, quartz, and other similar substances.* Dated April 8, 1863.

This invention relates—1, to the crushing of auriferous, argentiferous, or other metallic ores; and 2, to the separation of the valuable portion from the inferior portions thereof. The improvements consist—1, in the employment and use of a heavy metallic crushing weight, hammer, or stamp, which is attached to a vertical shaft, upon which adjustable tappets are secured, and which are acted upon by lifting cams in such a manner as to lift the hammer and allow it to fall by its own weight, the angle of the cam effecting the partial revolution of the hammer or stamp at each stroke, so as constantly to present a different surface to the ore, which is supplied beneath the hammer upon a die or foundation, the whole being enclosed in a casing or mortar; the crushed ore issues therefrom by means of a screwed aperture with a wood partition on the opposite side, so as to keep away the pressure of water against the screen, which is provided with an outlet at the bottom to regulate the height of the water in the mortars. When crushing wet ore, a space is left in this mortar lined with copper, and amalgamated with mercury, so as to retain any gold or precious metal that may come in contact therewith. A second part of the invention relates to an arrangement of apparatus for separating the finely crushed particles from the rougher or coarser portions, and consists in the use of a chamber divided into compartments, each having a stream of water passing through it. The pulverized ore is admitted to the part of the chamber above the partitions, and at right angles to the course of the water stream, so that the heavy portion of the ore falls into the first compartment, the lighter and finer into the second, and so on, where they subside to the bottom, whence they may be removed by means of a pipe and tap. A third part of the invention relates to the further separation or dressing of the ore, and consists in a number of "hopper" or delivery boards, one supplying the table with the pulverised ore, and others supplying water thereto. The table is suspended at an angle, and caused to reciprocate laterally by means of an eccentric, or cams and rod, so that the ore is evenly spread over the surface at the upper edge of the table, but by the reciprocating motion the valuable portion accumulates at one side of the table, the middle quality nearer the centre, and the inferior portion at the other side, the discharge thereof being continuous. *Patent completed.*

885. J. N. Brown. *Improvements in securing or connecting the bearing springs of railway carriages and waggons to the axles boxes of the said carriages and waggons.* Dated April 8, 1863.

According to one of these improvements, the patentee substitutes for the spring rivet an eye-bolt, the head of which eye-bolt passes through the top of the grease chamber in the axle box. A bolt or pin is passed through the side of the axle box, underneath the top of the grease chamber, and through the eye of the eye-bolt. This being done, the nut of the eye-bolt at the top of the spring is screwed up, and the spring is then firmly secured to the axle box. Another of these improvements consists in extending the lugs which form part of the spring box a sufficient distance down the sides of the axle box to enable a bolt to be passed through the said lugs and underneath the top of the grease chamber, as before. Or, instead of using a bolt, the same object may be accomplished by using a screw pin on each side of the axle box, the said screw pins being tapped into the axle box. *Patent completed.*

886. T. Gray. *Improvements in preparing and bleaching jute and other vegetable fibres for spinning and other purposes.* Dated April 8, 1863.

The patentee claims—1, the omission of boiling material in alkali before bleaching it; 2, the mixing of soda ash or other alkali with the bleaching liquor before the material is immersed in it, the material being thus rendered considerably stronger than that bleached by the ordinary process, and whereby it acquires a permanent snow-white colour. *Patent completed.*

887. J. R. Harris. *Improvements in propelling vessels.* Dated April 8, 1863.

This invention relates to giving motion to vessels by means of propellers enclosed within the body of the vessel, except at those parts of them which are for the time acting on the water for the purpose of propulsion. The inventor forms the propellers with radial or other suitably formed floats or boards, and with enclosed sides, so that the space between adjoining floats or boards may form chambers open at the periphery for action upon the water; and he encloses these propellers—except where they act directly upon the water—within boxes or compartments formed for them in the hull of the vessel. By these means, only the part of the propellers for the time acting projects from the vessel, and at the same time the back action of the water is avoided. Each of the propellers may be worked by a separate engine, or may be otherwise operated, in order to their being caused to revolve as required in the same or opposite directions. *Patent abandoned.*

888. W. E. Gedge. *Improvements in apparatus for propelling and navigating small craft.* (A communication.) Dated April 8, 1863.

The object of this invention is to employ scientifically in the navigation of boats, barges, and other small craft, the corporal power which boatmen and others in a great measure waste; also to render such navigation easy to those who have found difficulty in navigating with the ordinary means; and to obtain greater speed with no greater expenditure of power. One part of this invention consists of an arrangement of oars with jointed points. These oars are made in two principal parts—namely, a wooden shaft and a blade of metal, wood, or other suitable material. A half-circular socket fixed on the blade, and running nearly its entire length, receives one end of the shaft lengthwise; it is of conical shape, and the shaft passes into its entire length, lying flat on the side of the blade, and is held by the conical shape of the socket. It cannot vacillate in this sheath, no matter what strain is brought upon it by the tension of the handle. A ferule is fixed on the shaft towards the handle, its lower part hinging on a jointed pivot fixed on the side of the boat. By this arrangement the oar may be inclined at pleasure, and placed deeper into the water while moving, if desired. *Patent abandoned.*

889. W. H. Mitchel. *An improved construction of barometer.* Dated April 8, 1863.

This invention is not described apart from the drawings. *Patent completed.*

890. J. L. Norton. *Improvements in machinery for washing and drying wool and other fibres and rags, also tentering, stretching, and drying fabrics.* Dated April [illegible] 1863.

For the purposes of this invention, in washing wool [illegible] other fibres or rags, a trough or vessel having a perforated or false bottom is employed containing washing liquor [illegible] water. An endless sheet or band with projecting teeth [illegible] pegs is caused to move from end to end of the trough. The fibrous materials or rags are fed on to an endless apron which conducts them into one end of the trough; they are then, by the teeth or pegs on the travelling sheet [illegible] band, taken through the water or washing liquor, and discharged on to another endless apron at the other end [illegible] the trough, and by it they are conducted to a pair [illegible] pinching or squeezing rollers. After the wool or [illegible] fibres or rags have been washed and squeezed, they are [illegible] be dried by being spread on an endless sheet of wire [illegible] composed of parallel spirals or helices of wire run into [illegible] other, by which a very flexible endless sheet is produced

peculiarly fitted for this purpose. This endless sheet is placed within an enclosed chamber with doors at each end. When the wool or rags are first fed on to the endless sheet, the door at the feeding end is opened, and as soon as the entire sheet is filled with wool or rags, the door is closed until the wool or rags are sufficiently dried. Both doors are then opened—that is to say, the doors at the feeding and delivery ends of the machine, and while the dry wool or rags are being discharged from the sheet at the delivery end of the machine, wet wool or rags are fed into the feeding ends of the machine until the whole is again charged with wet material, and then the doors at each end are again closed until the material is dried, and so the process is repeated. In tentering, stretching, and drying machines, where the endless chains move in upright or horizontal guides, the patentee encloses the chambers containing them, and applies coils of pipes fixed between the cloth to be dried and steam jets, in a similar manner to that above described, by which such machines are made more advantageously than heretofore. In place of gearing the rollers over which the endless chains of tenters pass by means of spur wheels on the axes of the rollers with intermediate spur wheels between the succeeding rollers, he applies a single shaft, and gives motion therefrom to the rollers by bevel toothed wheels on such shaft, and on the axes of the rollers. In order to suit the rollers of tentering and stretching machines more effectually than has heretofore been done to receive varying widths of fabrics at different times, he constructs each roller of three parts, and each part is formed with parallel bars, leaving spaces between the parallel bars, in order that the bars of the two outer parts of a roller may slide between the bars of the central or third part of the roller, whereby a roller—whether at its smallest length, or expanded to its greatest length, or to an intermediate length—will be of the same diameter. *Patent completed.*

891. A. KINDER. *Improvements in coating or covering lead, or alloys of lead, with tin or alloys of tin, and in the apparatus employed therein.* Dated April 8, 1863.

This invention relates to certain modes of coating or covering, lead, or alloys of lead, with tin or alloys of tin, on one or both sides, whereby the two metals or alloys may be perfectly united, forming one solid ingot, which is to be subsequently reduced to the desired thickness by the ordinary processes of rolling or beating. According to one method, the patentee first casts a plate of lead or alloy of lead in any convenient mould, and as soon as the metal or alloy is set, he removes it from the mould, and places it in a second mould upon a flat table. This second mould is made with moveable or adjustable sides, so as to be capable of contracting to any desired size. The sides are also adjustable in height above the surface of the table, in order that they may project more or less above the surface of the lead plate contained between them. He then casts upon the lead, whilst it is still in a heated state, a sufficient amount of molten tin or alloy of tin to completely cover the lead, the thickness of this covering being regulated by the height of the sides of the contractable mould above the lead. The surface of the tin is levelled and smoothed off whilst in a heated state by passing a metal or felt roller or sleeker over its surface; the roller running along the top of the two slides of the mould, any superfluous metal is thereby removed, and is ready for the process of lamination. *Patent completed.*

892. H. B. FOX. *Improvements in dish covers.* Dated April 9, 1863.

These improved covers are constructed of any number of scales or pieces formed by preference (when for round dishes) from sections of a hollow semisphere, connected together at the points by a joint in such a way that the scales or plates of the cover will fold into or over each other. An oval dish cover can be formed from scales or pieces which are portions of a semi-oval or compressed semisphere. The shape of the scales or pieces from which the covers for both round and oval dishes are formed may be of other shapes than those partaking of the arch, and the covers may be constructed of other forms than round or oval, and they may be made to open from the centre, folding down on each side of the dish; and oblong covers may be formed to open either longitudinally or transversely as desired. *Patent abandoned.*

893. D. J. COOKE. *Improved compounds or compositions for sizing, stiffening, and colouring yarns and textile fabrics.* Dated April 9, 1863.

For sizing and colouring worsted braid and fine cotton yarns the inventor mixes about 20 lbs. weight of farina or potato flour, 20 lbs. of sago flour, 15 lbs. of rice flour, and 6 lbs. of glue with sufficient water to make it of a suitable consistency, and adds to the said mixture or compound any suitable colouring matter to give the materials the desired tint or colour. The said mixture will be sufficient for about 112 lbs. weight of worsted braid. He makes gelatine size for stiffening grey, white, or coloured goods made of cotton, linen, or other fibrous materials, whether in the state of yarn or woven fabrics, by mixing about 280 lbs. weight of rice flour, 280 lbs. of wheat flour, 112 lbs. of farina or potato flour, 56 lbs. of sago flour, and 16 lbs. of glue with a sufficient quantity of water to make it workable, and adds the necessary colouring matter. *Patent abandoned.*

894. S. T. HEATH. *The application of glass for ceilings and the like overhead parts of houses and other structures.* Dated April 9, 1863.

Those parts of dwelling-houses, theatres, public and other buildings, such as the ceilings, the inside surfaces of roofs, the under surfaces of galleries, and other overhead parts, all which are usually constructed of lath and plaster, and those parts of ships, such as the cabin and state room ceilings, or, in other words, the under surfaces of decks, the lower part of screens, theatre scenes, and other like overhead parts, are, according to this invention, formed partially or wholly of glass, silvered, transparent, opaque, figured, coloured, or otherwise, but preferably silvered. *Patent abandoned.*

895. F. J. RISSE. *An improved haft or handle for holding tools or instruments of various sizes.* Dated April 9, 1863.

This invention consists in a combination of parts hereinafter described, by means of which one haft or handle is made capable of holding various sizes of files, joiners' chisels, and such tools or instruments as require hafts or handles. For this purpose the patentee screws the ferule, which is usually placed on the haft or handle, partially internally, and he chases a corresponding screw on that part of the haft or handle which is usually made of wood, to receive a portion of the ferule; the remaining part of the screwed surface of the ferule contains a cylindrical piece of metal, hollow or partially so, and secured on its outer surface to a pitch corresponding with that of the ferule. The cylindrical piece of metal contains jaws or nippers working on centres which turn on grooves cut in the cylindrical piece of metal above named. By this apparatus, when the "tang" of a file or other instrument required to be held is placed within the jaws or nippers above named, the jaws or nippers are made to hold the instrument fast by causing the ring of metal carrying them to come to such part of the ferule that the outer surfaces of the jaws or nippers press against the internal surface of the ferule, the various lengths of the "tangs" of different files and instruments being accommodated by a spring placed underneath a cover in the centre of the haft or handle. *Patent completed.*

896. G. SPENCER. *Improvements in preventing incrustation in steam engine boilers.* Dated April 9, 1863.

This invention consists in preventing incrustation in steam engine boilers in the following manner:—The patentee places on some convenient part of the boiler in connection with the steam space a close vessel of iron, or other suitable metal, of a cylindrical or other suitable form, furnished with a number of diaphragms or dishes placed in each vessel, one over the other. Through the centre or sides of such vessel he brings the feed water pipe, so that the feed water is discharged into the top dish or diaphragm, from which it flows into the next under through holes or spaces furnished with raised edges not quite so deep as the raised edges of the outside of the dish, so that the water may all pass into the next lower dish by such holes or spaces. There being a series of such dishes, the water passes from the feed pipe into the top dish, then from that through the spaces into the next lower dish, and so on through the whole series of dishes. The object of this contrivance is to catch and retain the salts held in solution by the cold water, and which are thrown down as a deposit on the boiling of the water in the dishes or diaphragms by the heat of the steam of the boiler, with which the whole inside surface of the vessel is always in contact. Or a series of dishes may be arranged having one with the longest diameter at bottom, and each one placed over this of a little less diameter than the one under it. These dishes have no holes or spaces in them; but the water passed by the feed pipe into the top dish flows over the raised edge of that dish into the one under, that when full into the next, and so on to the bottom one, and, lastly, in either case, through a hole in the boiler top and into the steam space of the boiler. As an additional security, he coats the surface of the inside of this vessel, and the dishes and the inside of the boiler and outside diameter of tubes or flues (if any), with a suitable substance, such as Green's oxide paint, to prevent the adhesion of the deposited metal. *Patent completed.*

897. A. HETT and F. W. BASSET. *Improvements in preventing the fouling of ships' bottoms and in cleansing the same when fouled.* Dated April 9, 1863.

The patentee claims the use of heated water, heated air, steam, or poisonous substances, vapours, or gases, whether heated or not heated, or smoke distributed over or upon or applied to ships' bottoms, for preventing the fouling thereof, and in cleansing the same when fouled. *Patent completed.*

898. J. RUDLEY, jun. and D. MCCOLL. *Improvements in preventing the escape of fumes and matters from furnaces.* Dated April 9, 1863.

For the purposes of this invention, the inventors propose to cause the current of gases from the furnace on their way to the chimney to pass through the interstices of some incombustible substance, broken into pieces of suitable size, so that the gases will, to a great extent, be deprived of the matter carried along with them by what may be termed filtration; and as the spaces between the brick, slag, or whatever incombustible substance is used, must necessarily be soon filled up, they propose to arrange the material so that the matter or fume deposited may be removed without suspending or impeding the working of the furnaces. For this purpose the incombustible material is contained in an iron framework or crate, made of the same height and width as the culvert which leads to the chimney, and the culvert is arranged so that the framework can be readily introduced into and removed from it. By this means, when the framework is filled with incombustible material, and is inserted in the culvert, the current of gases from the furnace must pass through the interstices between the material in it. The culvert is, by preference, arranged so that two or more frameworks may be introduced into it, in order that before removing one framework from the culvert another one may be introduced into it. They also propose to prevent the escape of smoke from engine and other furnaces where coal is used, by retaining the solid particles which escape from the chimney constituting what is commonly called smoke. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated July 8, 1863.

1698. T. Preece, Leominster, implement maker. An improved corn and seed drill.

Dated August 4, 1863.

1918. C. Gouty, La Tour, France, fuller. Improvements in fulling, thickening, felting, and cleansing cloths, and in apparatus connected therewith.

Dated October 6, 1863.

2444. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in steam boilers and furnaces. (A communication.)

Dated October 7, 1863.

2448. E. Jones, Gorton, near Manchester, engineer. Improvements in apparatus to be used for pumping water out of mines and other places.

Dated October 10, 1863.

2489. D. Proudfoot, Glasgow, drysalter. Improvements in printing or dyeing textile fabrics.

2490. J. W. Goundry, Old Shildon, Durham. Improvements in musical instruments.

Dated October 16, 1863.

2532. E. Rowing, Norwich, engineer. Improvements in steam engines and boilers.

2535. F. G. Stuber, 20, Waterloo-road, teacher. Improvements in lamps and stoves for the application of blast heat to horticultural, agricultural, and other specified purposes.

Dated October 17, 1863.

2549. E. H. C. Monckton, Cavendish Club, Regent-street. Improvements in the means of uniting or joining plates or sheets of metal, which invention is applicable to the construction of boilers, tubes, and other useful purposes.

Dated October 19, 1863.

2553. H. Gilbee, 4, South-street, Finsbury, London. An improved composition for rendering boots and shoes and other similar articles waterproof. (A communication.)

2556. J. Whitley, Leeds, brass and iron founder. Improvements in the permanent way of railways.

Dated October 20, 1863.

2562. C. T. Morley, Birmingham, stationer. Causing a more complete combustion of gas in using it for lighting purposes.

2567. H. Hennessy, Wynnefield, Charleville-road, Dublin. An improvement in projectiles.

Dated October 21, 1863.

2581. C. Schiele, Clarence-buildings, Manchester, engineer. Improvements in governors.

2584. T. Hodson, Preston, mechanic, W. Nightingale, Preston, factory operative, and R. Laird, Preston, mechanic. Improvements in machinery for carding cotton and other fibrous materials.

2587. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in treating ligneous substances in separating and recovering the fibrous portions therefrom, in preparing, bleaching, and sizing the same, and in machinery employed therein. (A communication.)

Dated October 22, 1863.

2592. G. Cutler, jun., 8, Wharf, Wenlock-road, City-road. Improvements in boilers and apparatus used for the generation of steam.

2593. R. Bailie, London-yard, Isle of Dogs, iron ship builder. Improvements in the construction of floating docks.

2594. H. Wilson, Stockton-upon-Tees, Durham. An improved lubricator for steam engines.

2596. A. A. Croll, Coleman-street, London, engineer. Improvements in the preparation of matters to be employed as disinfectants.

2597. C. Tusnot, Chaussée de Waterloo, 121, St. Gilles-lez-Bruxelles, manufacturer. Certain improvements in the manufacture of cartridge bottoms or entire cartridges composed entirely of the same elements.

2600. J. Mitchell, Dyke-head, Lanark, gentleman. Improvements in sinking, quarrying, and excavating in the earth.

2601. C. Parker, Dundee, Forfar, machinist. Improvements in machinery or apparatus for winding yarns or threads.

2605. C. J. Pownall, Jermyn-street, Westminster. Improvements in preparing and cleansing vegetable fibres, and in machinery employed therein.

2606. W. W. Burdon, Newcastle-upon-Tyne, esq. Improvements in reducing and preparing wood for the manufacture of paper and pulp.

2607. R. A. Brooman, 166, Fleet-street, patent agent. A new material for tanning. (A communication.)

2608. H. Bridson, Bolton, bleacher, and J. Alcock, millwright. Improvements in machinery for plaiting or folding fabrics.

2609. T. Dickins, A. L. Dickins, and H. Heywood, Middleton, Lancashire, silk dyers. Improvements in dyeing threads of silk.

2610. A. Turner, Leicester, elastic web manufacturer. Improvements in looms for weaving.

Dated October 23, 1863.

2613. M. A. Boyle, Claremont-house, Holland-street, Kensington. Improvements in portable writing cases and despatch cases.

2615. J. Claes, 18, Rue de l'Echiquier, Paris, patent agent. An improved apparatus for regulating the emission of gas. (A communication.)

2616. J. T. Webster, Mansfield, Nottingham. Improvements in driving the spindles of doubling and spinning frames.

2618. V. J. Cassaignes, 35, Rue de Rivoli, Paris. Improvements in the manufacture of the prisms, lenses, and glasses of stereoscopes, and in ornamenting glass.

2620. J. Parker, 6, Lilford-road, Camberwell, gentleman. Improvements in the application of steam combined with air as a motive power, and for other purposes.

2621. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved mode of manufacturing railway wheels. (A communication.)

Dated October 24, 1863.

2623. W. Betts, Wharf-road, City-road, capsule manufacturer. Improvements in the manufacture of metallic capsules for bottles and similar vessels, and in the apparatus or means for applying or fixing such capsules thereon.

2624. E. S. Crease, Tavistock, Devonshire, mining engineer. Improvements in machinery for drilling, boring, or excavating rock or other earthy substances.

2625. J. Davidson, Leek, Staffordshire, silk manufacturer. Improvements in doubling yarns or threads of silk and other fibrous substances, and in the machinery employed therein.

2626. J. Thomas, 5a, Great Bolton-street, Kennington-park, gas meter indicator maker. Improvements in gas meter indicators.

2627. G. Haseltine, 12, Southampton-buildings, Chancery-lane, civil engineer. A new attachment to coverings for the head, and to other articles of dress, for lighting matches. (A communication.)

2628. F. B. Baker, Sherwood-street, Nottingham. Improvements in apparatus used in dressing lace and other textile fabrics, and suitable also to the application of dyes or colouring matters thereto.

2629. J. Brown, 27, Aldgate, J. T. Way and T. M. Evans, 106, Leadenhall-street. Improvements in preparing cements and varnishes.

2631. L. J. Hannart, Brussels, Belgium. An improved clasp or fastening for gloves or other wearing apparel, for umbrellas, travelling bags, or other similar objects.

2633. A. Sellar, Reading. An improved instrument for lubricating rifles and other descriptions of firearms, also ordnance.

2635. A. Alison, 72, Sloane-street, Chelsea, gentleman. Improvements in atmospheric railways, and in carriages for the same.

Dated October 26, 1863.

2637. B. Steinmetz, 97, Rue Notre Dame des Champs, Paris. Improvements in locks for bags.

2639. T. Marsh, Sheffield. Improvements in projectiles.

2641. M. Vian, Marseilles, shipbuilder. Certain compositions for preserving iron ships and other submerged iron work from corrosion and decay.

2643. W. E. Gedge, 11, Wellington-street, Strand. An improved pillow. (A communication.)

2645. J. Willcox, 1, Ludgate-hill, London, sewing machine manufacturer. Improvements in sewing machines. (A communication.)

2647. E. Clifton, ironmonger, and B. Greenwood, brush manufacturer, Manningham, Bradford, Yorkshire. Improvements in the manufacture of brushes used in machinery employed for preparing and combing wool, cotton, silk, and other fibrous substances.

Dated October 27, 1863.

2649. T. H. Holderness, Liverpool, merchant. Improvements in propelling navigable vessels.

2651. T. Grason, Manchester, merchant. Certain improvements in boots, shoes, clogs, and such like coverings for the feet.

2653. W. Livingstone, 51, Glengall-road, Poplar, engineer. An improved machine for punching, shearing, and rivetting metals.

2655. P. B. O'Neill, Warwick-street, Regent-street, gentleman. An improved salinometer, which is applicable also as a hydrometer, and for other similar or analogous purposes.

2657. E. R. Hollands, 16, Charles-street, Northampton-square, machinist. Improvements in machinery for punching, cutting, and pressing metals and other materials.

2659. W. Firth, Burley, Leeds, merchant, S. Firth, gentleman, and J. Sturgeon, consulting engineer. Improvements in machinery for cutting and boring coal, stone, or other minerals.

Dated October 28, 1863.

2661. J. Marshall, Stockport, Chester, cotton spinner. Certain improvements in apparatus for applying adhesive substances to spindles employed in spinning cotton and other fibrous materials and for the lubrication thereof.

2667. R. Needham, Dukinfield, Cheshire, and J. Pollitt, Heywood, Lancashire, engineers. Improved equilibrium valves for steam engines and other purposes.

2669. M. Henry, 84, Fleet-street. An improvement in, or addition to, military knapsacks, travelling bags, and other similar articles. (A communication.)

2675. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in clocks, watches, and other timekeepers. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated October 28, 1863.

2663. W. E. Gedge, 11, Wellington-street, Strand. An improved system of permanent advertisement. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, November 10, 1863.

1525. J. G. Jennings and M. L. J. Lavater. Stoppers.
1628. A. K. Richards. Ordnance and firearms.
1633. J. Blake. Apparatus for reducing and regulating the pressure or quantity of steam.
1653. W. Snell. Waterproof material. (A communication.)
1636. T. Boyle. Ventilation.
1637. C. P. Coles. Apparatus for working guns.
1645. J. J. Shedlock. Wet gas meters.
1652. C. Martin. Materials for the manufacture of paper.
1653. H. Broadhead and G. Murdoch. Breech-loading ordnance.
1654. W. E. Newton. Skins. (A communication.)
1655. R. Davison. Cleaning corn. (A communication.)
1662. M. E. Eyth. Rotative engine.
1663. J. McDonald. Jacquard looms.
1671. G. A. and A. Barrett, W. Exall, J. Andrewes, and J. L. Bowhay. Thrashing machines.
1680. G. C. Collyer. Cut tobacco.
1685. G. Bartholomew. Shoes.
1699. A. G. Southby. Diverse lamps.
1723. C. de Bergue. Piles for foundations.
1736. J. Orr, J. Brinton, and J. Lewis. Weaving "chenille."
1739. H. Greaves. Railways and tramways.
1744. H. N. King. Producing spectral illusions on the stage.
1784. L. R. Bodmer. New product from peat. (A communication.)
1787. J. Lamb and S. Tovey. Looms.
1802. J. H. Johnson. Machine knitting-needles. (A communication.)
1843. M. A. Soul. Expelling solid and liquid refuse matter from steam and sailing ships. (A communication.)
1848. W. Clark. Saddles. (A communication.)
1888. W. and S. Firth. Apparatus for working coal and other mines.
1989. L. R. Bodmer. Dressing and finishing yarn. (A communication.)
2050. A. Cruickshank. Food for cattle.
2140. F. C. P. Hoffmann. Shears.
2145. G. Attack. Bearing springs.
2176. W. Boulton and J. Worthington. Encaustic tiles.
2207. J. Burch. Printing on certain and other terry and velvet pile carpets.
2220. E. T. Hughes. Chenille. (A communication.)
2347. A. Collingridge. Casks.
2352. T. and W. Marshall. Metallic instruments.
2393. J. Chidley. Bottle and stopper.
2515. J. Rowley. Fibrous materials.
2549. E. H. C. Monckton. Joining plates.
2574. G. H. Daglish and T. Windus. Bending plates for iron ships.
2583. G. Howell. Condensing metallic and other fumes.
2588. Z. Colburn. Steam engines.
2593. R. Baillie. Floating docks.
2661. J. Marshall. Adhesive substances to spindles.
2728. J. Tangye. Shearing and rivetting machines.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed November 6, 1863.

1177. B. Hargreaves.
1178. R. Burgess.
1183. R. A. Brooman.
1186. J. E. McConnell and G. H. Bovill.
1191. J. E. McConnell and G. H. Bovill.
1192. W. Whiteley.
1210. T. Lawrence.
1241. W. Watson.
1270. W. Walker.
1272. W. Nunn.
1248. C. Barnard, J. Bishop, C. Barnard, jun., and G. Barnard.
1280. J. Goodman.
1293. E. Barlow, J. Ashworth, J. Newhouse, F. Hamilton, and W. Hope.
1309. H. A. Bonneville.
2087. L. E. C. Martin.
2132. H. W. Putnam.
2144. L. E. C. Martin.

Sealed November 10, 1863.

1189. T. Warren.
1195. R. A. Brooman.
1197. R. A. Brooman.
1199. R. A. Brooman.
1203. J. E. McConnell and G. H. Bovill.
1208. J. Farmer.
1209. R. A. Brooman.
1212. A. Pilbeam.
1219. I. Parker.
1220. B. Shillito and D. Moor.
1222. D. M. Fyfe.
1224. A. Macmillan.
1225. R. T. Mallet.
1226. J. Patterson.
1229. B. Browne.
1232. F. M. Burns.
1235. J. Gibbs.
1236. W. White.
1238. E. B. Wilson.
1239. J. Whitehead.
1269. G. R. Harding.
1275. N. J. Amies.
1277. W. H. Clapp.
1278. E. Sonstadt.
1306. J. Hesford.
1307. W. Muir.
1320. W. Clark.
1326. F. W. and J. Kitson.
1332. H. J. Kennard.
1341. C. F. Baxter.
1362. W. Clark.
1431. C. Nicquet.
1485. J. S. Benson and D. Jones.
1499. W. Clark.
1522. A. Samuelson.
1899. A. R. Arrott.
2128. J. Alison.
2142. A. Rowand.
2188. G. Hargreaves.
2239. T. J. Sloan.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2983. R. Harrison and G. Taylor.
2763. W. Spence.
2788. R. W. and J. Waithman.
2815. J. Stockley.
2725. C. Asprey.
2728. J. Higgins and T. S. Whitworth.
2800. J. Crooke.
2742. A. J. Sedley.
2826. G. Glover.
2760. J. W. Wallis.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2585. H. Bessemer.
2593. W. Weild.
2639. H. Bessemer.
2596. C. Titterton.
2642. F. J. Manceaux and E. N. Vieillard.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending November 7, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
645	0 4	653	2 10	662	0 4	671	0 8	679	0 4	687	0 8
646	0 4	654	0 10	663	0 8	672	0 10	681	0 8	688	2 2
647	0 10	655	0 10	664	0 4	673	2 0	682	0 4	689	0 4
648	0 4	656	0 10	665	0 8	674	1 2	683	0 4	690	0 4
649	0 10	657	0 10	666	1 6	675	0 10	684	0 4	691	0 8
650	0 4	658	0 4	667	0 4	676	0 4	685	0 8	693	0 10
651	0 10	659	0 4	668	1 2	677	1 2	686	0 4	894	0 8
652	1 6	661	0 4	669	0 10	678	0 8				

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LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£ s. d.		£ s. d.	per
Iron:—					
Welsh Bars, in London	per ton	7 10 0	to	0 0 0	2½
Nail Rods	do	8 0 0		8 10 0	
Hoops	do	10 10 0		0 0 0	
Sheets, single	do	11 10 0		0 0 0	
Staffordshire Bars	do	9 10 0		0 0 0	
Bars, in Wales	do	6 10 0		6 15 0	
Rails	do	7 0 0		0 0 0	nett
Foundry Pigs, at Glasg, No 1	do	3 0 0		3 6 0	
Swedish Bars	do	11 10 0		12 10 0	2½
Steel:—					
Swedish Keg, hammered	do	16 0 0		16 10 0	
Swedish Faggot	do	17 0 0		18 0 0	
Copper:—					
Sheet & Sheathing, & Bolts	do	106 0 0		0 0 0	
Hammered Bottoms	do	115 0 0		0 0 0	
Flat Bottoms, not Hamrd	do	110 0 0		0 0 0	
Tough Cake and Ingot	do	98 0 0		0 0 0	
Tile Copper	do	98 0 0		0 0 0	
Best Selected	do	101 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½		0 0 9	
Fine Foreign	per ton	100 0 0		102 0 0	
Tin:—					
English Block	per cwt.	5 15 0		0 0 0	2½
do Bar	do	5 16 0		0 0 0	
do Refined	do	6 0 0		0 0 0	
Banca	do	6 3 0		6 3 0	nett
Straits	do	5 17 0		0 0 0	
Tin Plates:—					
Best Charcoal, I.C.	per box	1 9 0		1 10 0	
Second Quality	do	1 7 0		1 8 0	
Coke	do	1 3 6		1 5 0	
Spelter:—					
On the spot	do	18 7 6		18 10 0	nett
Zinc:—					
English Sheet	do	24 0 0		0 0 0	2½
Quicksilver	per btl.	7 0 0		0 0 0	3
Regulus of Antimony:—					
French star	per ton	35 0 0		0 0 0	2½

Timber, duty 1s. per load, drawback 1s.

Teak	load £12 0	£13 0	Archangel, yellow	£13 0	13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
" yellow pine	3 10	4 10	Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0	Memel	10 0	15 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
" birch	3 10	4 10	" white	9 0	9 10
" elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderhamn	9 10	10 0
" fir	2 10	3 10	Christiania, per C., 12ft. by 3 by 9 in.		
Memel fir	3 5	3 10	Christiania, yellow	21 0	23
Riga	3 0	3 5	Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 4
Swedish	2 10	2 15	Pumice Stone pr ton	5 10	9 0
Masts, Quebec red pine	5 0	6 0	**Oils, &c.**		
" yellow pine	5 0	6 0	Seal, pale ... per tun	47 10	48 0
Lathwood, Dantzic, fm	5 10	6 10	Sperm body	78 0	79 0
" St. Petersburg	8 0	8 10	Cod	56 0	57 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Whale, Sth Sea, pale	45 0	46 0
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	59 0	60 0
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	48 0	0 0
Yellow pine, per reduced C.			Palm, fine	38 0	38 10
			Linseed	42 10	43 15
Canada, 1st qual.	17 0	18 0	Rapeseed Eng. pale	42 0	0 0
" 2nd do.	11 0	12 0	Cottonseed	31 0	35 0

FRENCH & SMITH, Sworn Brokers, 4, Brabant-court, Philpot-lane, E.C.; and at 4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 20, 1863.

BESSEMER SCRAP AND ITS USES.

The art of welding steel in large masses still constitutes the *pons asinorum* of the ironmaster. By the aid of the magnificent machinery of the present day, we can twist, turn, knot, shear, and punch colossal bars and plates of iron with as much ease as the baker works his dough; yet the process of welding remains as difficult, uncertain, and troublesome as though the excogitations of the inventor had never been devoted to the subject. It is true that steel is welded daily; that it will punch and flange like copper, yet sustain a strain of 120,000 lbs. per square inch; but the materials which permit of such manipulation partake more of the kindly nature of iron, than of that stubborn determination to break rather than bend, which is so uniformly associated in the mind with the term steel. It is not, perhaps, easy to say where we are to draw the line of demarcation, or to define exactly what is iron and what is not. The degree of carbonization will scarcely settle the question; for the quantity of carbon necessary to bestow a share of the qualities of steel on iron, may vary with different samples in a very remarkable degree. This much we do know: cast iron will not weld, be it ever so pure, and free from silica, phosphorous, sulphur, or any other of those foreign substances which it is the object of the manufacturer to eliminate; and the more nearly any sample of wrought iron, steel, or homogeneous metal, resembles the pig, the more unlikely is it that it will possess those welding qualities which would so materially enhance its value. To judge by the records of the Patent-office, any improvement in this department of the iron manufacture has been generally regarded as hopeless, until recently. Few and far between are the specifications as it is, which detail "improvements in the process of welding steel;" yet any one, acquainted with the nature and magnitude of the demands made daily on the skill of the smith, would see that it is from no want of inducement, apparently, that there has been a dearth of labourers in this field for invention. The world wants a thousand things made of steel, which it must continue to want, until we can contrive the means by which the stubborn metal can be welded with the ease and certainty of wrought iron. When shall we have cast steel faces welded on our armour plates? When will steel cables be supplied to our ships? When will incompressible steel top flanges be welded comfortably on to our deck beams and bridge girders? Built-up steel guns, we have got, perhaps as a first instalment; and we regard them as prophetical of the steel armour plates, cables, anchors, and girders, which are sure to follow ere long.

Meanwhile, Mr. Bessemer's magnificent process is said to be open to a serious objection. Good as his metal is, it is asserted that the scrap from it is useless, that it cannot be re-welded, and that it will not re-melt or combine with facility with new metal in the converting vessel without deteriorating the quality of the entire charge. These are grave statements, and deserve at least careful consideration. The quantity of Bessemer scrap made annually at many works, must be measured by hundreds of tons; and even though the difficulties in the way of its re-working may not be sufficiently great to preclude its use altogether, they may be quite enough to render that re-working a very unprofitable undertaking. If such is really the case, the introduction of Mr. Bessemer's process into extended use would be materially retarded—a result very much to be deprecated. We confess that we cannot discover any rational foundation for the statement in an extended form; yet it is quite possible that the objection is urged in all good faith. The manufacture of Bessemer metal is not confined to one firm; and, in consequence, its quality is as varied as that of any other substance which is made to supply a demand. In other words, it may be had extremely good, or extremely bad. Certain samples have been compared, we do not doubt justly, to refined pig iron. These, of course, will neither ball nor weld in the hands of the smith; but it is absurd to make a sweeping assertion on the faith of the deductions drawn from such premises. We have seen plenty of bad scrap wrought iron ere now, which could scarcely be welded in the first instance, or made available for anything but the commonest purposes subsequently. Yet no one condemns wrought iron scrap generally, because a few particular cases of the nature stated, are met with now and then. It is not easy, perhaps, to define what "scrap" is. Some firms class waste pieces of iron of all dimensions under this head; and when these are very considerable, the mass is absolutely worthless from the difficulty of re-working it. Some months ago, we saw the intermediate shaft of one of the Holyhead mail boats lying in Messrs. Boulton and Watt's yard at Soho. A scarcely perceptible crack had led to its replacement by another. The vast size of the shaft effectually precluded its re-manufacture. It could not be cut up cold. It would never pay to heat and forge it. Nothing remained, save perhaps, to set it up on end in the earth as a foundation for the anvil block of a steam-hammer. Verily, "scrap" is often useless, although it never traced its origin to the converting vessel.

Mr. Bessemer has not permitted the aspersion on the character of his process to pass unnoticed. An able letter from his pen has appeared in the pages of a cotemporary, in which he informs us, not alone of what may be, but of what actually *is*, done with "Bessemer scrap." Alluding to the first and most obvious use of this material, he tells us "that all the Bessemer scrap steel made in one establishment during the last two years has been sold to cast-steel makers, who melt it in crucibles in the same way as practised by them in working up the ordinary scrap steel made by the old process." The very details indeed, of his own system, offer the simplest of all possible means for rendering scrap steel a marketable commodity. The crop end of bars and ingots, can in this way be re-manufactured without any appreciable amount of labour being expended in their re-conversion into ingots of any desired weight or form. When these scraps are of small size they are sometimes thrown cold into the converting vessel; in some cases as much as 2 cwt. of cold steel scrap being used with every ton of melted crude iron; these scraps become completely fused during the converting process, and thus form an addition to the weight of ingots, obtained without any increase in the labour, fuel, or engine power employed to produce them. It has, however, been found preferable to heat the scrap previous to putting it into the vessel, and in this way Mr. Bessemer informs us that large masses of steel, weighing from 5 cwt. to 7 cwt., have been perfectly fused in the converting vessel during the short space of time occupied in the conversion of a charge of crude iron. Did no other means of disposing of his chips and parings present itself to the ironmaster, here at least, is one which can be employed to good purpose.

Bessemer steel is worked up, however, in hundreds of situations, where the converting vessel and the melting-pot are not accessible, and other methods of manipulating scrap must be resorted to. The steam-hammer is nearly ubiquitous; and there is, apparently, no good reason why steel rail-ends, ingot crop, plate shearings, &c., should not be worked up into serviceable bars by its aid. Here we begin to tread on tender ground. The practicability of welding Bessemer scrap depends just as much on matters of detail, which are governed by general laws, as the working of any other description of steel. "The property of welding," says Truran, "belongs to all metals, whether cast or malleable, but is most apparent in iron. It is produced by the infusion of caloric, until the iron and metalloids of the entire mass are softened, and the surfaces to be united reduced to a semi-liquid state. The comparatively large quantity required to liquefy wrought iron, enables the softening and partial fusion to be successfully conducted. Cast iron and other metals may be united by fusion; but during the accession of caloric, owing to the lesser quantity required and the inferior melting temperature, only a momentary period elapses between the softening and complete liquefaction of the entire mass treated, and the rapidity with which it escapes, does not permit of the manipulation necessary to the effectual consolidation of the pieces." The amount, by which the entire quantity of heat necessary to fuse a certain sample of Bessemer metal is less than that which would be required to fuse a like quantity of wrought iron; and the difference between the melting points of the two metals, at once determines the difficulty of welding the former effectually. In other words, the more nearly such a sample approaches in its nature to the harder cast steels, the greater the obstacles to be encountered in working it under the hammer. It is quite possible that metal may be, and probably is, made under the Bessemer patent, which is little better than cast iron when heated, crumbling to pieces by the effects of percussion, though tough enough when cold. For such scrap as this there is at present nothing but the melting pot. But this is not a usual characteristic of the material in question; and even if it were, it is by no means certain that the failure of the welding process is not more due to the lack of inventive genius on the part of the ironmaster, than in the imperfections of the metal sought to be worked. It is quite possible that the hardest cast steel may yet be welded on a large scale, with ease and certainty, by the aid of properly contrived machinery. Certain it is, that we weld steels now which could not have been welded a little while since; and the march of improvement may yet supply us with the means of producing, with a facility not known at present, that combination of pressure with percussion, which seems best adapted to forming a perfect union between the half-fused surfaces. Every smith who has had much to do with the forging of steel tools, is well aware of how greatly his success depends on the nature of the blows struck in the first stage of the operation of welding; and we can very well understand why certain manufacturers have failed in welding particular samples of so-called Bessemer metal.

Fortunately, the material which is produced by the aid of the converting vessel and its tuyeres, partakes far more of the qualities of soft wrought iron, than of hard steel, when the crude metal is of proper quality, and the process carried out as it should be. It is not our

purpose at present to dwell on the merits of Bessemer metal; but that it can be welded under proper arrangements with the greatest facility, when it assumes those characteristics of a mild pure steel which it ought to possess, there can be no doubt whatever. One of Mr. Bessemer's licensees, writing to him, says: "I have been making a pair of railway axles by piling the ladle scrap; and we have made such a perfectly sound job of them, that I think I shall never again make axles in any other way." So long as he supplies himself with the proper material, it is more than probable that this gentleman can pursue the method he proposes with success. Much greater things than this have been done, however, in the way of piling scrap or crop end. The London and North-Western Railway Company, having on hand the crop ends taken from five hundred tons of Bessemer steel rails, proceeded to pile these in precisely the same manner as practised in piling scrap iron. These piles were made into flat slabs, and were afterwards used to form the top and bottom sides of other piles, composed of old iron railway bars, and were then rolled into new railway bars, having steel faces, and the central part of common iron. More than one hundred rails were thus made, and after many unsuccessful attempts to detach the steel, both by hardening in water and by other means, they were laid down for use upon the line. Here we have an instance not only of the welding of Bessemer steel scrap, but also of its perfect welding to ordinary wrought iron; and the simple fact that all these scraps resulted from five hundred tons of Bessemer steel, made by not less than five hundred consecutive repetitions of the converting process, is excellent evidence that the metal in question, of a uniform welding quality, can be made with certainty in the regular and ordinary way of trade.

V. P.

TURBINES.

The class of water-wheels, known by the general term "turbine," supplies us with, perhaps, the most practically perfect means to be met with in the arts of obtaining the highest results from given mechanical effects. To all intents and purposes, the turbine is if properly constructed, a perfect motor, capable not alone of working under all sorts of circumstances and under the most variable conditions, but of invariably giving out a high coefficient of useful effect as well. Perhaps invented, at all events first rendered effective and economical, by Fourneyron, in 1837, it has gradually worked its way into general favour solely by its own merits. It is not easy to say how many of them are at work in Great Britain at the present moment. Messrs. Williamson, Donkin, Schiele, the North Moor Foundry Company, and many other firms, have, we believe, full employment found them in their construction; while abroad their use is even more extended than it is here in the fatherland of the steam engine—the giant who will scarcely brook the presence of a competitor within his territorial domains. In France and Germany, the turbine enjoys great favour; the comparatively high price of fuel acting to some extent, as a bar to the habitual use of steam machinery. In America, the ordinary vertical water-wheel was exclusively employed—the breast-wheel being considered best—until 1844. In 1843, Mr. Elwood Morris communicated to the Journal of the Franklin Institute, a translation of Morin's experiments on turbines, which attracted considerable attention. The year after, Mr. Boyden, an engineer experienced in the manufacture of hydraulic machinery, designed and constructed a horizontal water-wheel for the Appleton Company's mill, near Lowell, in Massachusetts, which at once embodied several improvements on the Fourneyron arrangement, and may be regarded as the first instance of this application of water-power in the States. In 1846, the same gentleman constructed three turbines, of about 190-horse power each, on the same general principles; the particular design being somewhat modified and improved. It is said that the mean maximum effect of two of these was found by careful experiment, to equal 88 per cent. of the theoretical power due to the fall—a statement which, probably, contains a slight exaggeration. The general principles and mode of formation which distinguish the Fourneyron wheel are so well understood that it would be superfluous to dwell on them individually at length. The water, distributed in horizontal jets by peculiarly curved vanes or guides, issues from the circumference of an inner fixed wheel, composed of two discs kept apart by the guide plates, and passing through an outer annular wheel, fitted also with guides of a contrary curvature, puts it in motion; its interior periphery revolving as nearly as possible, in contact with the exterior periphery of the inner or guide wheel. This is the Fourneyron turbine in its simplest form. One of the most important improvements effected by Mr. Boyden, was the application of the "diffuser," almost universally adopted since. The invention is embodied in the formation of two large stationary discs without and around the wheel, the space between which at the inner periphery is very little greater than that between the crowns of the wheel at the part next to them. These discs curve apart and outward, so that the space at their exterior periphery is twice as great. The section through which the water passes in escaping from the wheel is thus enlarged in the ratio of one to four; hence its action should fall from 1 to 1-16th in the same distance, provided the wheel be submerged. The effect of this arrangement is to reduce the pressure on the escaping water, and thus increase the power as though the fall were increased. The theoretical gain to be derived by this arrangement is equal to about 5 per cent. on the whole power; though from one cause or another only 3 per cent. is usually realized. Mr. Boyden suspended his turbine from above, and was the first to point out the expediency of employing very thin guide-plates and vanes. One of the greatest objections to the Fourneyron wheel and its modifications is, that, being always submerged, it is, to some extent, inaccessible for repairs or examination. It is frequently far from convenient to drain away the water, especially when more than one turbine is supplied from the same race. As early as the year 1838 this objection was recognized, and the "Jonval" wheel introduced to obviate it. Instead of revolving outside the stationary guides, the buckets in this turbine revolve below them. Both the fixed and moveable wheels are placed within a tube of sufficient diameter, the orifice of which, placed below the level of the water in the lower race, is so contracted as to allow of only the proper quantity of water passing through, due to the velocity arising from the difference of the two levels above and below the turbine. By this arrangement the wheel may be placed in any part of the height of the fall deemed most desirable; the necessary force and velocity of the water being obtained by the pressure of the atmosphere on the upper surface of the suspended liquid column. When the supply of water is cut off by closing the upper sluices, the wheel is left high and dry for repairs, as the tube is usually large enough to afford ample space for a man to work in it with ease.

When the turbine is employed to render high falls available, the foot-step of the vertical spindle often gives much trouble, as well from the difficulty of lubricating it properly, as from the great weight which it has to sustain, and the high speed at which the shaft revolves. At St. Blasier, in the Black Forest, a wheel only 13 in. in diameter is put in motion by a column of water 354 ft. high. Whether all the pressure due to this vast height is rendered available or not, we cannot say. The wheel makes 2,200 revolutions per minute, driving 8,000 water spindles, with the necessary machinery for slubbing, roving, &c. Fifteen hundred revolutions per minute are by no means uncommon with larger wheels. Mr. Boyden, in America, and Mr. Mallett, in this country, cut the Gordian knot by hanging the revolving ring and its shaft, and all the weight of water upon it, from a ring of conical rollers above the pen-trough, running between two faced-up iron plates, the central toe or step being used merely as a steadier. When the foot-step is retained, the best practice is to form a cavity in the end of the shaft, which is fitted accurately to a hardened steel pin, projecting upwards, firmly fixed in the base of the wheel pit, on which the entire weight is sustained. The proper shape for this pin and its corresponding cavity has been made the subject of much mathematical disquisition. Oil is usually supplied through an aperture drilled up the centre of the pin, by a very small force-pump, put in motion by an eccentric on some slow running shaft in the mill above. In the great Fairmount Jonval turbines, intended to supply water to the city of Philadelphia, the central shafts are supported on stout cast-iron columns, bolted down to the iron bottom of the draft box or vertical tube. A socket resting on the top of this column contains a circular block of lignum vitæ, 15 in. in diameter and 8 in. or 9 in. thick. Its upper surface is rounded to a partially spherical shape, and a few spiral grooves are cut in its surface to permit the entrance of water, and thus secure constant lubrication. A cast-iron socket, hollowed out to fit this block, is keyed on the lower extremity of the vertical shaft, thus forming the bearing. These wheels are, perhaps, the largest of the kind in the world, being not less than 9 ft. in diameter over the buckets; each wheel, we believe, drives a nearly horizontal double-acting pump, 18 in. in diameter, and 6 ft. stroke, intended to make twelve double strokes per minute when pumping against the head of water in the reservoir.

The construction of the turbine suggests some of the most complicated problems in hydraulics, and theory scarcely yet affords the means of solving them. Practice alone supplies us with thoroughly trustworthy results. From this reason, there is little doubt that the statements of the usual effect realized from a given fall are frequently over-estimated. the quantity of water passing through the wheel being really in excess of that assumed from calculation. Still, making every allowance, there is no doubt that with proper care turbines usually give out a higher coefficient of useful effect than perhaps any other moving power in existence. At first sight, it appears that the entering water should impart a severe shock to the curved buckets which oppose its motion. This diappears, however, when the wheel moves at a proper velocity. Under correct arrangements, the water enters the wheel without impact, and passing along the

whole length of the blades which constitute the buckets, and exercising a pressure at every part, whereby its velocity is constantly reduced, while the direction of its motion is modified by their curve, it finally leaves the wheel with an insensible motion, being deposited as it were in the tail race, from which it flows in obedience to the law of gravitation at a velocity determined by the inclination of the floor on which rests. In order to secure this action, the most extreme accuracy of workmanship is absolutely essential. It is useless to set out the proper curves with a strictly mathematical precision, if these are afterwards departed from by an erroneous method of practical construction. Theoretically, the guide curves should have no thickness; and although this desideratum is unattainable, we can, at all events, approach almost indefinitely near to it. It is not easy to secure the necessary accuracy of fitting through all the details, by hand labour. The more extended use of machine tools specially designed to carry out the end in view, and of cast steel as a material of construction, may do much to reduce the first cost and improve the performance of the turbine; the latter imparting that stiffness and strength which cannot be obtained from the use of sheet-iron. It is impossible to over-estimate the importance of correct form, and it requires little reflection to show how easily thin guide plates may be deflected by the pressure of the water when the wheel is at work, although, when at rest, their shape may leave nothing to be desired. Machine tools would rapidly and cheaply impart that smoothness of surface and delicately beautiful curvature to the guide plate and buckets, on which the efficiency of the machine almost wholly depends.

THE ORDNANCE REPORT, 1863, CONDENSED; AND CONCLUSIONS FROM IT.*

No. II.

In the first part of our analysis, a plain narrative of events, in the order of the dates, proved the exceptional position and commanding influence of Sir W. Armstrong in the War Department, from the beginning to the end of his career. By the same process we will, from the evidence, show the composition of the company formed by him, and its preferential position over all other manufacturers of ordnance.

THE ELSWICK COMPANY AND ITS COMPETITORS.

The Elswick Ordnance Company was the creation of Sir W. Armstrong. His name does not appear as one of the partners in the contract with the War Department, which is printed *in extenso* in the Appendix, but his personal interest was identified with it. This it would be idle to affect to doubt. The company was formed for his purposes and to carry out his views. Whilst he was in the service of the Government, at a salary of £2,000 a-year, the company's works were under his control. He was at the same time engineer of rifled ordnance at Woolwich and director at Elswick. The Government guarantees, beginning with £12,000 to Mr. Armstrong, and ending with £85,000 to the company, furnished the capital. The form of the guarantee is a masterpiece of ingenious contrivance. It was framed by an astute mind learned in the law. It provided, in the most stringent manner, that the company should incur no loss to the extent of the sum guaranteed by their expenditure on land, buildings, and machinery. With such a guarantee, and such a guarantor, double the largest sum named could be, and in fact was, readily obtained on easy terms. The secured capital invested in this promising undertaking amounted to £168,000. This amount, be it observed, was the fixed capital. The floating or trading capital, looking at the vast extent of the transactions, probably was at least as much more; we shall, no doubt, be within the mark in setting the gross capital down at £300,000. The firm "slept on velvet;" there could be no loss; full employment of the works was guaranteed, and there was no limitation to the prices to be charged.

Doubtless it was the privilege of the author of the scheme to nominate the lucky partners. We learn from the Report the names of some of those gentlemen—they are Mr. George Cruddas, Mr. Richard Lambert, Mr. George W. Rendel, and Capt. Andrew Noble, R.A. Of the two last named, the first—a son of the late Mr. Rendel, the celebrated engineer—was brought up under the guardianship of Mr. Isambard Brunel, the brother-in-law of Sir Benjamin Hawes, the Under-Secretary of War; and the latter was Secretary of the two War-office Committees, on whose reports the Armstrong ordnance, of every calibre, was adopted into the military and naval service of Her Majesty. If there are other members of the firm, their names are not disclosed. We may, however, considering the large capital involved, reasonably conclude there are sleeping partners. Mr. Rendel and Capt. Noble were both young men; neither of them had any commercial experience before undertaking the management of the Elswick Company. We leave the public to form their opinion of the coincidence, which made the Secretary of two Committees which reported in favour of the Armstrong ordnance, and a family connexion of a high official of the War-Office, co-partners of the fortunate projector, and instruments to carry his plans into effect. When we come to the cost of the Elswick guns and projectiles, we shall find the prices paid for them were on the most liberal scale, considerably higher than the cost of the same articles at the Woolwich factory.

We have shown from the evidence how, by a series of events, the Armstrong party obtained a position to command success. We say *party*, because it clearly results from the evidence that a number of persons were engaged, and had a common interest with Sir W. Armstrong in carrying out his views. We proceed to point out by what means success was insured and competitors were kept aloof or frustrated.

At his *debût*, in 1854, Mr. Armstrong at once obtained an order from the Duke of Newcastle for six guns. This means three things invaluable to an inventor—a fair or rather an indulged trial of his invention; the patronage of Government; the expenses paid from the public purse. These advantages were in vain sought for by other projectors. The successive proposals of Mr., and afterwards Sir, W. Armstrong, during five years, met with the same exceptional success, with reference to the three essential points, and gave him an immense superiority over all other artillery inventors.

They had to work their weary way up the official mountain and encounter rebuffs at every stage, whilst the road was made smooth to Messrs. Armstrong and Co. In July, 1855, the trial of the first gun met with qualified success; soon afterwards it was re-bored and again tried, and another gun was ordered. To suit the convenience of Mr. Armstrong, who was absent on the Continent, the trial was delayed some months. These preliminary experiments were of great value to the inventor; he was enabled to correct his errors, and modify his plans, continually favoured with the cordial co-operation of the Ordnance officials. At the beginning of 1858, it is clear from the evidence, that the arrangements then made were destined to give to the future Sir W. Armstrong, that preponderance of preparedness, requiring much time and careful combinations, which should enable him to distance all competitors at the trials, which were to determine the adoption of a system of rifled ordnance for the two services.

After carefully going through the correspondence and reports, from January, 1858, to January, 1859, and comparing the incidents recorded in the Ordnance Report during that eventful twelvemonth, we are painfully impressed with the conviction, that Sir William Armstrong and his friends were in the secret; whilst all other artillerists, who might, and many of whom would, have been competitors, were in profound ignorance of the nature of the trials, which were to take place so soon as the Armstrong preparations were completed. Between February and April, 1858, Mr. Armstrong received from the Ordnance authorities the orders for the guns and projectiles, which, towards the close of that year, were used in the so-called competitive experiments. When the time came, he was fully prepared with guns of different kinds, calibres, and projectiles of every denomination. So much were all other projectors taken by surprise, that Mr. Whitworth was the only one who entered the lists, and he had not at the time the most remote idea of what was really intended. It might be supposed we are over-stating the case, so incredible does the proceeding appear; but we will leave the facts furnished by the Report to speak for themselves.

To elucidate the true state of the case, we call attention to the appointment, in September, 1858, of the "Special Committee on Rifled Cannon," of which Colonel Mitchell was president, and Captain A. Noble, secretary. Some weeks previously, there was note of preparation, in the War Department, for the coming decision, by "General Peel calling on Colonel Lefroy, the President of the 'Ordnance Select Committee,' to report on all the experiments that had been tried on rifled ordnance."

In a letter to Colonel Mitchell, dated the 8th September, 1858 (Appendix, p. 399), he is informed, *by order of General Peel*, that the Committee is appointed "to consider and report upon the best form of rifled cannon for adoption in Her Majesty's service, as well as of the projectile to be used with it; to ascertain the best pattern of rifled gun for garrison and for field service; likewise to ascertain whether there be now in existence any pattern or patterns of rifled cannon fit for adoption into the service;—the paramount importance of arriving at a speedy decision on those questions" is pointed out, and the Committee are "empowered immediately to proceed to experiments as they may consider necessary." In this despatch the Armstrong system, although not mentioned, was, doubtless, in the "mind's eye" of the Secretary of State. It was well known in the Ordnance *bureaux* that no other artillery projector was in such a state of preparation, as to admit of the immediate adoption of his plan, or even to give him the chance of competition with Sir W. Armstrong; General Peel's decision,

* ERRATA in No. 1 of the Condensed Report, pp. 784, 785.—3rd column, for "Col. Lessing," read "Col. Lefroy." 3rd and 4th columns, for "1848," read "1858;" for "Col. George," read "St. George." 4th column, two sections commencing "In October, 1859" and "4th Nov., 1859," should precede the section commencing "This Naval Gun." 5th column, for "contemptousness," read "contemptuous."

therefore, on this matter was simply a prelude, in form, for the adoption of the favoured system. He himself, and the Ordnance officials, were well aware that there was no competitor prepared to oppose Sir W. Armstrong, who could not fail to walk over the course.

All this at the time was known only to the initiated. Neither in the title of the Rifled Cannon Committee, nor in any public or private notice, did anything appear to lead artillerists to suppose that the object of that Committee was to "test the strength of guns and their capabilities to fire various projectiles," or "to come to a speedy decision on the best form of rifled cannon for adoption for garrison or for field service." So little did many of them anticipate decisive trials of that nature, that they were wondering that their plans for those purposes, which had been proposed to the Government some years ago, had not been submitted to experiment. There can be no doubt, looking at his intimate official relations at that time, Sir William Armstrong was fully cognizant of the nature of the proposed proceedings, and took his measures accordingly. He knew that that Committee was appointed to determine, principally and forthwith, what system of field guns should be adopted to the exclusion of all others. The evidence of all the other projectors, who had, during the preceding three or four years, submitted proposals to the War-office, proves they were misled and mystified, not having had the same opportunities, as Sir W. Armstrong, of knowing what was really intended. Those who knew anything supposed that the only question to be determined by the Rifle Committee was the *best system of rifling ordnance.*

The proceedings which threw off all candidates for Ordnance contracts, except Sir W. Armstrong, were thus conducted :—Inventors were invited to adopt their modes of rifling and strengthening cannon to cast iron guns, on the ground of the importance of utilizing the immense stores of that description of ordnance in the Royal Arsenals. A number of distinguished artillerists, comprising Commander Scott, R.N., Mr. Lancaster, Mr. Whitworth, Mr. Bashley Britten, and Mr. Lynall Thomas preferred their claims. Sir W. Armstrong entered the lists with his "shunt," the lead-coated compression system not being applicable to muzzle-loaders. Several 68-pounder and 32-pounder cast-iron guns were strengthened and rifled on the various plans proposed. Considerable delay took place before the experiments were completed and reported. Dates here are important. This scheme of competition, which looked fair and reasonable, commenced in 1857 and 1858; the results were not realized till 1860. In the meantime Sir W. Armstrong alone, practically, had the privilege of submitting *wrought-iron* rifled guns to be experimented upon at the public expense; and this he did, with the favour and indulgence before described. Every competitor but himself looked to the trial of his plan of rifling is applied to those cast-iron guns, and when the result of the competition was made known, they learnt with amazement that the whole question was decided by the experiments with the Armstrong built-up guns, in which they had no opportunity of participating.

In support of this view of the case, we now quote the evidence from the Report. Appendix No. 62, p. 546, dated War-Office, 27th June, 1863, is a "Return of strengthened Cast Iron Guns (some Rifled) which have been tested in Experiments by the Ordnance Select Committee since the year 1858." It gives the particulars of the trials of 20 guns, of which it will suffice to detail the results of three guns, which in the return take the highest and lowest places, as determined by the number of rounds fired before the guns burst.

Names of Artillerists.	Nature of Gun.	Weight of shot. lbs.	Weight of charge. lbs.	Number of Rounds.
No. 1, Bashley Britten and Blakely	32 pr. rifled	... 67½	... 8	... 133
No. 2, do. ...	32 ,, ,,	... 48	... 5	... 84
No. 3, Lancaster...	32 ,, smooth-bore	32	... 10	... 81
No. 16, Captain Caffin, R.N., Director of Stores.........	32 ,, ,,	... 35	... 16	... 22
No. 17, Armstrong shunt	68 ,, rifled	... 80	... 18	... 12
No. 18, do. ...	68 ,, ,,	... 90	... 13	... 4

The Bashley Britten system of rifling, combined with the Blakely plan of strengthening, stands pre-eminently at the head; the Lancaster takes an honourable second rank; the Ordnance candidates are at the bottom of the list, the Armstrong "shunt" being the most inefficient of all the plans of rifling. These were the results with cast-iron guns; but they are *comparative*, they prove the superiority of the Britten and Blakely systems over the Armstrong, and leave no doubt that the same superiority would be maintained in wrought-iron guns. Nevertheless, Sir W. Armstrong, with his usual good fortune, has had a number of wrought-iron guns, of large calibre, made at the public expense on the shunt principle, and received the aid of the War Department to introduce them into the service as naval and siege guns. On the other hand, Mr. Bashley Britten and Captain Blakely have, in vain, made reiterated attempts to obtain the privilege of having even a single gun on their principle experimented upon. The gallant officer's proposal to supply a heavy gun at his own expense was refused.

(*To be continued.*)

INSTITUTION OF CIVIL ENGINEERS.

November 10, 1863.

JOHN HAWKSHAW, Esq., President, in the Chair.

THE Paper read was "Description of Lighthouses lately erected in the Red Sea," by Mr. W. Parkes, M. Inst. C.E.

Having been instructed by the Board of Trade to make the necessary preliminary surveys for establishing lights to facilitate the navigation of the northern portion of the Red Sea, the author recommended three sites—1st, Zafarana Point on the Egyptian shore, 50 miles from Suez; 2nd, the Ushruffee Reef, on the western side of the navigable channel of the Straits of Jubal, 150 miles from Suez; and 3rd, the Dædalus Reef, in the centre of the Red Sea, 350 miles from Suez, and 180 miles from the entrance of the Gulf of Suez. These sites having been approved by the Egyptian Government, by the Board of Trade, and by the directors of the Peninsular and Oriental Steam Packet Company, the immediate execution of the works was authorized upon designs submitted by the author.

Zafarana Point being on the mainland, it was considered most advantageous to construct a tower and lightkeepers' dwellings of rubble stone, and to employ native labour entirely, under the direction of H. E. Linant Bey, the chief engineer of the Public Works Department of the Egyptian Government. The design presented no feature calling for special remark, and the works had been carried on in a very satisfactory manner. The light was a fixed dioptric of the first order, visible over five-eighths of a circle at a distance of fourteen miles. It was first exhibited on the 1st January, 1862.

The main features of the other sites were then described. The Ushruffee was a coral reef, of which the sides sloped irregularly from the level of a few inches under low water to a depth of from eight to ten fathoms, no part being above the water, and there being very little sand, even in the cavities of the coral. The Dædalus Reef was a submerged island, with a flat top of an oval form, 1,200 yards in length and 450 yards in breadth, the sides being generally vertical, or in some places even overhanging. The actual surface of the coral was about 6 in. under low water; but there was a small shifting bank of sand near the south-east end which was dry at low water, and sometimes also to a small extent at high water. The range of tide was about 2 ft. at springs.

The peculiar conditions which had to be considered in designing the proposed constructions were—first, the force of the sea would be completely broken at some distance within the edge of the reef; secondly, the structures would have to be built upon the surface of the reef, and not be sunk into it, as no additional security could thus be obtained, while the advantage of the natural platform would be lost; thirdly, in the absence of any definite experience as to the actual weight which the reefs would bear without being crushed, it was desirable to keep the weight per superficial foot of foundation as low as possible; fourthly, the buildings had to be designed so as to mitigate the intense summer heat; and fifthly, in the case of the Dædalus, as the materials would have to be brought from Suez, and, as there was no anchorage, it was necessary that a steamer should be employed capable of keeping close to the reef in any wind, and of providing quarters for the workmen and storage room for the materials, until a proper depot and habitation could be formed on the reef itself. These requirements rendered it essential that the materials should be small in bulk, that the several parts should be light and easily handled, and that the mode of putting them together should be as simple as possible.

It appeared to the author that these conditions would be best attained by adopting a structure of wrought iron supported on teak piles, resting on, and the feet bedded in, a layer of concrete, so as to distribute the weight, the surface of the concrete being a little above the level of high water; and that, by filling in the wrought-iron framework with strong corrugated iron, so as to form a series of rooms one above the other, as a central column, with verandahs or galleries around each room, likewise partially enclosed, a portion, at least, of the sun's rays would be prevented from falling on the walls of the rooms, while there would be a free admission of air.

As the Dædalus light had only to guard against the dangers of the reef on which it was placed, it was not necessary that that structure should exceed the limited height that would allow of four tiers of rooms, and of accommodation for the lighting arrangements. These together brought the light to an elevation of 62 ft. above the mean level of the sea. As the Ushruffee light had to lead vessels past dangers twelve or fourteen miles distant, a more powerful light, at a greater elevation, was required. The height fixed upon was 125 ft. above the mean level of the sea. The framework was of the same description in both cases; but in the latter case there were eleven tiers, whereas in the Dædalus there were only four tiers. Details were then given of the Ushruffee structure, as being the larger of the two. It was stated that this structure was supported upon eighteen piles, each 18 ft. long and 18 in. diameter, arranged in two concentric circles. The inner circle consisted of six piles, and was 15 ft. diameter, while the outer circle was formed of six pairs of piles (the piles of each pair being 6 ft. apart), 37 ft. diameter at the top, and the feet spread outwards at a batter of 1 in 12. The feet of the piles rested upon the natural surface, and there were shoulders on each side of the piles resting on sleepers of teak, bedded on the concrete 3 ft. to 3 ft. above the surface of the coral. The heads of the piles passed through circular wrought iron collars, to which they were accurately fitted, and any loosening by the shrinkage of the timber, was provided for by fitting a number of wedges of greenheart timber into corresponding grooves in the pile heads, in which they could be driven down when slack. A direct bearing surface was also given by iron screws, 2 in. diameter, which passed through each collar, and entered 2in. into the wood. The collars had projecting arms, to which the bottom framing was rivetted. The superstructure consisted of a repetition of three main parts, which might be called respectively, standards, sills, and radiators. In each tier there were twenty-four standards, arranged in two concentric circles, and these were connected at the top and bottom by sills, thus forming two twelve-sided polygons, the corresponding angles of which were connected by the radiators. With the exception of a few parts near the bottom, no separate piece exceeded 4 cwt. in weight. The floors of the rooms were composed of cast-iron plates covered with concrete, and from the lower floor there was suspended a hemispherical water tank, capable of holding 1,500 gallons. The floors of the galleries were formed of open cast-iron gratings. The whole of the ironwork of the stru-

ture was erected on Messrs. Forrester and Co.'s premises, at Liverpool, with the view of attaining the accurate fitting of the parts and of testing its strength. While at its full height, with the exception of the piles at the bottom and the lantern at the top, but with the joints merely bolted together, it was exposed, in September and October, 1860, to two gales of wind of the registered force, respectively, of 20·5 lbs. and 24·3 lbs. per square foot. There was no appearance of any straining of the joints, and a careful examination failed to discover any swaying movement at the top, though there was a sensible vibration. Since its erection on the reef it had been subjected to two severe gales, in June, 1862, and in January, 1863, with similar results; for, although the top of the building had vibrated, there were no symptoms of straining having occurred.

The general principles of the construction of the Dædalus lighthouse were the same as those of the Ushruffee, with such modifications as its smaller size demanded; thus there were only twelve, instead of eighteen piles, and the dimensions of the parts of the framework were the same as for the upper tiers of the Ushruffee. The building was stated to be very stiff, scarcely any vibration being perceptible under a strong breeze.

The lanterns were of the same construction for the three lighthouses. Those for the Ushruffee and Zafarana, being for first-order lights, were identical in every respect. That for the Dædalus, being for a second-order light, was of reduced size. In construction they were similar to those generally manufactured for the Trinity Corporation, but with special arrangements for mitigating the powerful effects of the sun. At the suggestion of Professor Farraday a wind-guard was substituted for the ordinary revolving vane and cowl. The lanterns and light apparatus were furnished by Messrs. Wilkins and Co., the optical portion having been manufactured by Messrs. Chance Brothers, whose improvements in lighthouse illuminations deserved special notice. The Zafarana and the Dædalus were fixed lights, while the Ushruffee had a revolving light frame.

The whole of the materials of the two iron lighthouses, and of the three lanterns and light apparatus, were, with some trifling exceptions, despatched from Liverpool within ten months from the date of the author receiving instructions to proceed to survey the sites, at a distance of nearly 3,000 miles from Great Britain.

As the structures were designed with a special view to the peculiar circumstances of the sites upon which they were to be erected, it was considered desirable to give some account of the operation of erection. The Peninsular and Oriental Steam Packet Company granted, gratuitously, the services of the "Union," a screw steamer of 300 tons and 60-horse power, the Egyptian Government paying for all wages, stores, and coal. The materials arrived at Alexandria on the 12th of November, 1860; but it was not until the 20th of December following that they were all received at Suez, and placed on board the "Union," which then sailed for the Ushruffee Reef. The expedition thus commenced was unfortunately not successful. The causes of the failure were given at length in the Paper; but it would be sufficient to state the results of the season's labour, which lasted three months. The piles were erected on the reef, and their heads were connected by the bottom iron frame. The whole of the ironwork was landed, and laid out in order upon one of the neighbouring islands. This was not originally intended, as the plan decided upon was to moor the ship as near as possible to the reef during the progress of the works, and to land and sort the materials upon the concrete base of the lighthouse itself. After a full inquiry into the circumstances which had led to this failure, the author was instructed to make arrangements for a new expedition, and he readily assented to the suggestion that he should remain on the spot until the operations, as to which difficulty had been anticipated, were completed. The permanent superintendence was entrusted to the late Mr. C. W. Scott (Assoc. Inst. C.E.), Captain W. Kirton being in command of the "Union." As the materials had been landed on the Ushruffee Island it was determined to form a land establishment for the working party there, rather than to quarter the men on board. This left the steamer free to carry a working party to the Dædalus, without interfering with the operations on the Ushruffee. The staff was re-organised, and the list of plant and of materials revised; but owing to several causes the operations were not resumed on the Ushruffee until the 8th November, 1861. The first step was to form the shore establishment. This occupied three weeks, owing to the want of skill of the native carpenters in getting the huts ready for occupation. During this time, however, some progress had been made at the lighthouse. The caisson of iron plates to enclose the concrete base had been set up, and about 200 tons of gravel had been placed upon the reef, where it was exposed to a wash sufficient to remove some of the clayey particles. The process of depositing the concrete was then commenced, the plan adopted being to deposit it upon sheets of tarpaulin, which sunk with the weight and protected the soft material from the action of the water, until a mass of several tons was collected. When the whole space was covered in this way up to above low-water mark, the remainder was deposited, as the state of the tide allowed, until the whole height of 5 ft. from the surface of the coral was complete. The first half of the concrete was formed of six measures of gravel to one of Portland cement, mixed in the lighters moored alongside the caisson. The second half was formed of lime, puzzuolano, and broken stone, in the manner usually practised in the country. The latter was mixed dry at Suez, and was wetted on being deposited.

When the success of the process of depositing the concrete was well assured, the author turned his attention to the Dædalus, which was reached on the 26th of December. A site for the lighthouse was chosen near a small sandbank of triturated coral, as it was determined to use the sand for the concrete, and as it was also convenient for bleaching boats, &c. The surface of this reef was very irregular, there being numerous hollow places, varying from 1 ft. 6 in. to 2 ft. in depth. A four-legged shears was set up on the intended site, and a platform fixed upon it at the level of the under side of the pile collars. Upon this platform was bolted together the plates forming the polygon to complete the inner circle of piles. The six piles were then successfully raised on end, and the collars were bolted to the polygon. When the six piles were fixed, the original stage was removed, and a new one was formed, to receive in a similar manner the outer polygon. This having been fixed in place, and the two polygons connected by the radiators, the outer piles were raised. The caisson plates were then set up, being first bolted together, and then partially rivetted. The whole of these operations occupied seven days and a quarter, the staff employed consisting of four workmen, and parties of from six to eight men from the crew. The lighter "Ushruffee" was then moored upon the reef, and the steamer proceeded to whence it returned with fifty tons of cement and twenty Arab labourers, under a native foreman, for depositing the concrete, and having a second lighter in tow. The concrete here used consisted of three and a-half measures of coral sand to one measure of cement. The first operation was to fill up the holes between the coral lumps with coal bags filled with concrete, so as to make an even surface to lay the tarpaulins upon. The deposit was then carried on in the same manner as at the Ushruffee. The quantity of cement, above alluded to, was only sufficient to comple three-fourths of the required height of the block. This occupied just eight days, and then the author returned to Ushruffee, and finding five tiers of that lighthouse erected and partly rivetted, he handed over the entire charge of both works to Mr. Scott, who shortly after proceeded, with a party of four mechanics, two rivetters, two labourers, and ten Arabs, in all, twenty, besides the crew, to the Dædalus. With these, in twenty-six days, the work being carried on only on twenty-one days, the whole framework was erected and rivetted together, two floors and the water tank were completed, and the lower room was enclosed. Two mechanics and four seamen were then placed in the building, with provisions and water to continue the work, and the "Union," with Mr. Scott and the remainder of the working party, returned to Ushruffee. Thus, in thirty-seven working days, the main portion of the building, now 57 ft. in height, was so far finished as to be habitable for a party sufficient to complete the remaining details. Had the ship been of larger burthen it was believed that these thirty-seven days might have been continuous, and that the whole would have been accomplished during an absence of about seven weeks from Suez. The author referred, in terms of highest praise, to the manner in which what might be termed the nautical part of the undertaking had been carried out by Captain Kirton. Subsequently, the materials for the lantern and lighting apparatus were deposited in the building, and afterwards one leading mechanic, two labourers, and five seamen completed the work between November, 1862, and the 1st of February, 1863, when the light was exhibited.

At the last mention of the Ushruffee the concrete base had been completed, and five out of eleven tiers of framing had been erected. During the absence of Mr. Scott and his party at the Dædalus, a European boat's crew of six men was engaged in conveying the remainder of the materials to the reef, and in sorting them there. On the return of the working party, the erection was rapidly proceeded with, in the face of much difficulty, from almost constant high northerly winds. The time actually taken in erecting the skeleton framework, 106 ft. in height, was two months, and the rivetting was completed within three months. The two succeeding months were occupied with the erection of the lantern and lighting apparatus, and completing the details of the building, and on the 1st July, 1862, the light was first exhibited.

In connection with this undertaking the profession had to regret the loss of a very promising young member, Mr. C. W. Scott, who towards the close of the operations was attacked with symptoms, which developed the seed of a disease of long standing, under which he succumbed after an interval of five months.

With regard to the cost, a mere statement of the total amount expended upon the two lighthouses, £55,211 in all, would convey an erroneous impression, unless accompanied by an explanation. The cost of the whole as an engineering work, independently of the employment of the steamer, might be taken at £32,079, including all contingencies, supposing the reefs to have been within a boating distance, say one mile and a half, and half a mile from Suez. If the steamer had been equipped at Suez, and had been continuously employed, then, on this supposition, the cost might have been £42,082. The remaining expenditure, £13,029, was entirely exceptional, arising mainly from the steamer being equipped at Bombay.

PROGRESS OF THE IRON TRADE IN THE NORTH.

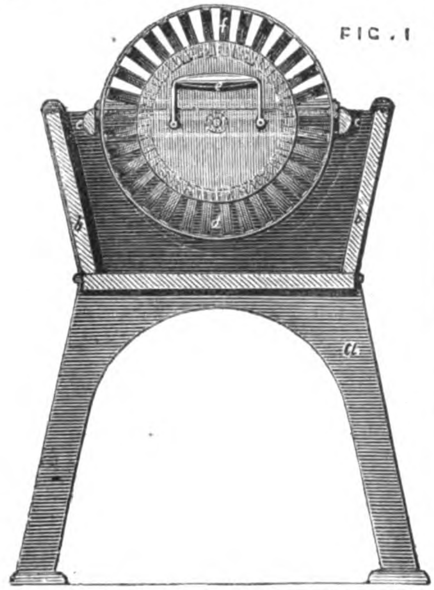
It is stated by the northern papers that Sir W. Armstrong has purchased or leased extensive ironstone beds in the neighbourhood of Bellingham. The old ironworks at Ridsdale-tor are not unlikely soon to be again in active operation, under happier and more successful management than the last. The ironworks at Bishopwearmouth also are about to be re-opened, which will be a great boon to the industrial and trading classes of that part of Sunderland. The iron trade of this district, indeed, extends with almost unparalleled rapidity. Including the Consett furnaces, there are already eighty-one blast furnaces in the Cleveland district, and preparations are making for building fifteen more. The quantity of ironstone sent from the Eston mines for the first six months of the year averaged not less than 13,000 tons per week. In one month the quantity reached as high as 14,000 tons per week! There is every reason to believe that if the trade continues to extend for the next ten years as it has done during the last, that the Teesside will be the largest iron-making district in the United Kingdom.

The Ordnance Select Committee of the War Department has ordered another telegraph cable of the firm of Messrs. Wells and Hall. It is to have four conductors, insulated with caoutchouc of the purest quality, in order to have insulation of the highest degree attainable. The external covering of the cable will be Russian hemp, braided over by a peculiar method, whereby the whole strain in paying out, or hauling in, will not cause any elongation of the cores—as experienced in spiral-covered cables. This cable, moreover, will be free from any twist—consequently, no kinking can possibly occur. The cable is being constructed in accordance with instructions given by Lieut. Noble, R.A., and will be required for submarine use. We believe it is intended for the experiments which are to take place at Shoeburyness with the Armstrong guns. In the experiments, the conductors of the cable will be connected with the floating target (now in course of construction at the Royal Arsenal), the other end will be in connection with the beautiful instrument of "Narvess" for ascertaining the velocity of projectiles. We may here remark, that the most perfect insulation is required in making experiments with this delicate apparatus—hence the cause of having caoutchouc for coating the conductors. We believe all the telegraph wires underground on the practice range at Shoeburyness are insula ted with this gum, and have given much satisfaction, having been two years embedded in the ground.

RICHMOND AND CHANDLER'S IMPROVEMENTS IN WASHING ROOTS.

THIS invention, patented by Messrs. Richmond and Chandler, of Salford, consists in an improved mode of constructing the cylinders or drums in which potatoes or other vegetables are washed; the cylinder or drum is formed with a cast-iron or other frame furnished with trunnions supported in bearings fixed to the ends of the trough containing water as usual; one half of the cylinder or drum is loose, and it is provided with handles by which it is easily removed from the frame in which it fits, and the other half is hinged to the frame, the two halves being connected together and to the frame by a spring catch or otherwise. The circumference and ends of the cylinder or drum (or the circumference only) are made with

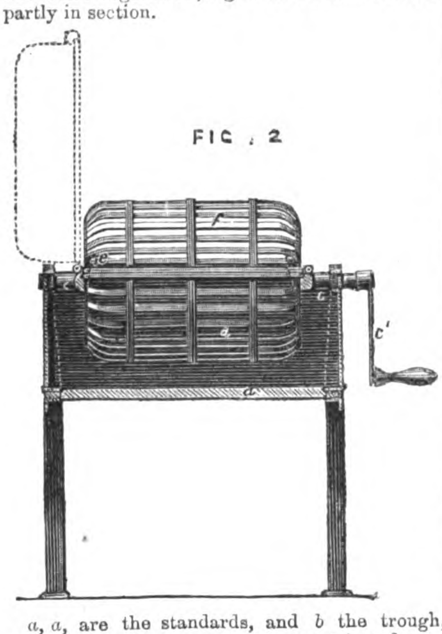
FIG. 1



strips or bars of galvanized iron or other suitable material. By this means the loose part of the cylinder or drum is easily taken out to remove the potatoes or other vegetables when washed, and to replace a fresh supply to be washed, and in some cases the machinery may be supplied with two loose portions to save time in removing the washed and supplying the unwashed vegetables.

Fig. 1 is an elevation in transverse section of the improved machinery for washing potatoes and other vegetables; fig. 2 is a side elevation partly in section.

FIG. 2



a, *a*, are the standards, and *b* the trough, which are made as usual; *c* is a cast-iron frame, the trunnions of which revolve in bearings provided for them in the standards *a*; *d* is the lower half of the cylinder or drum which fits on projections cast in the swing frame *c*; this half of the cylinder or drum has handles *e*, *e*, by which it can easily be lifted out of the swing frame; *f* is the upper half of the cylinder or drum, which is hinged to snugs cast on the swing frame, and when the cylinder or drum is closed, as shown in figs. 1 and 2, the two halves are held together by a split pin, or in any other convenient manner. When the potatoes or other vegetables are in the cylinder or drum, it is turned round in the trough containing the water by the handle c^1; when the vegetables are sufficiently cleansed the lid *f* is opened, as shown in dotted lines in fig. 2; the lower half *d* of the cylinder or drum is then lifted out of the swing frame *c* by the handles *e*, and another one with a fresh supply of vegetables to be washed is put in its place, or, if there is only one loose half to the machine, the same half is put back into the swing frame after the clean vegetables have been removed and a fresh supply has been put in. By this means the operation of washing vegetables can be greatly accelerated and labour economized.

Legal Intelligence.

BEASLEY *v.* BLAKELEY.

On Friday last, a case of some interest was tried at the Court of Exchequer, before Mr. Baron Martin and a common jury.

The action was brought for goods sold and delivered. The defendant pleaded Not guilty.

Mr. Serjeant O'Brien and Mr. Gates were counsel for the plaintiff; and the Hon. G. Denman and Mr. Watson for the defendant.

The plaintiff is the executor of Mr. Astbury, ironfounder, of Smethwick, near Birmingham; and the defendant is the well-known inventor of the Blakeley Gun. In June, 1862, the defendant called at the foundry and ordered a particular gun, on the Sardinian model, to be sent to him, for which he was to pay £75. The gun chosen was rifled to one-twelfth of an inch, but he directed it to be rifled to one-eighth. There being some difficulty in doing it, they substituted another gun, which was similar in every respect to the one chosen, having previously informed the defendant of what he had done, and to which no objection was made. Three weeks after the gun was delivered, a letter was received from the defendant, informing the plaintiff that the gun was not of the description he had ordered, and asking him to take it back; but he declined to do so.

The defence was that a gun was ordered capable of throwing a particular shot, and that the gun sent was not capable of doing so. He therefore sent the gun back. The defendant ordered a gun on the Sardinian model, and the one which was sent was of the American pattern.

The learned judge summed up, leaving it to the jury whether the plaintiff had established the fact that by the non-answering of the plaintiff's letter, and the non-return of the gun, the defendant had entered into a new contract by which he agreed to accept the substituted gun. If there was any wilful misrepresentation as to the make of the original gun, the contract would be void.

The jury returned a verdict for the defendant.

PREVENTION OF DECAY AND OXIDATION IN SHIPS.

(*Concluded from page* 789.)

IN 1852, Mr. J. Murdoch invented a variety of driers for zinc when the white of zinc is employed instead of white lead. The protoxides are manganese, cobalt, iron, tin, and nickel; for acids, the benzoic, urobenzoic, and the boric. In 1852 also, Mr. Binks patented a substitute for linseed or drying oils, in the products derived from dissolving what are called insoluble soaps. A pigment is then ground in this solution, and the paint is ready for application. The pigment may be white lead, oxide of zinc, lamp-black, or any other. J. C. Medeiros, in 1853, proposed the use of mercury or quicksilver on iron plates for sheathing ships. The salts of mercury are dissolved, then a bath is formed, and the plates allowed to remain in the solution till their surface is equally and regularly amalgamated.

Mr. Newton, in 1854, made a paint from ground plumbago, pulverized charcoal, and the black soot formed by the burning of bituminous matter, along with ivory-black, or bone or lamp-black. Mr. Ryder also, in 1854, described a method for mixing gutta percha with common resin, or tar, pitch, or asphaltum, dissolving them in impure benzole or coal naphtha. Mr. Newton took out a second patent, in 1854, for the production of a siccative black, brown, or grey pigment and colouring matter, by the admixture with the gas tar, or other organic substance to be carbonized for the purpose, of the oxides of potassium, sodium, calcium, aluminium, or other alkaline or earthy bases for paints. Mr. F. Ransome, in 1854, patented a mixture, consisting of ground oxides and carbonates of lead or zinc, and carbonate or sulphate of barytes with soluble silica. Mr. J. Rogers, in 1855, to prevent oxidation, deoxidizes metallic ores by a revolving cylinder, fitted with helical or screw-formed divisions to receive the ores in a pulverized state, and then submits the same to heat and constant agitation by the revolution of the cylinder. Mr. B. Rosenburg, in 1855, manufactured a paint as follows:—100 lbs. of triturated white lead, 2½ gallons of copal varnish, 1½ gallon of spirits of turpentine, 1½ gallon of linseed oil, and, for colouring, a small quantity of red lead. Before the metal is painted it is subjected to the fire for cleansing, and when cool the preparation is applied, then varnished with copal, and dried by a hot-air process. Mr. J. E. Cook, in 1855, proposed a composition consisting of gum shellac, dissolved in methylated spirit or in wood spirit. In 1856, the patent of Messrs. Bancroft and White claims the manufacture of oils from petroleum, for preserving metals and ships' sheathing. Mr. A. F. Mennons, in 1856, obtained a patent for a non-conducting and inoxidable composition for metals, made thus:—

Argillaceous clays, containing a certain proportion of alumina	100 parts.
Oily substances and residues	6 ,,
Oil sediment	5 ,,
Fat..	2 ,,
Animal charcoal..........................	2 ,,
Mucilaginous substances, such as glue, &c.	2 ,,
Wood sawdust, already employed in the purification of oils in the processes of dyeing	10 ,,
Waste hair well beaten	4 ,,

To the preceding materials a decoction of logwood and soot is then added.

Mr. J. M'Innes, in 1856, was granted a patent for coating metals with powdered emery stone mixed with a varnish of shellac dissolved in spirits of wine, with the addition of castor oil. As emery contains 87 per cent. of aluminium, Mr. M'Innes considered that this paint would be solid enough to resist all action in the water, and never decompose. Mr. R. D. Atkinson, of Hull, in 1856, invented a plan for coating and protecting metals from oxidation, by depositing copper or brass upon surfaces of prepared iron, the deposit to be melted in conjunction with carbonic acid gas, the coating to be put on by a brush, or through the medium of galvanism. Depositing brass on iron is now being successfully carried out at Portsmouth, by Mr. Wielan on armour plates and other iron surfaces. Mr. A. Reid, mineralogist, in 1856, describes in his specification what he deems a sure way of preventing oxidation. He places the iron in a properly constructed furnace, then covers the metal with soot, or other matters possessing the like element; the temperature is then raised to red or white heat, and continued for half an hour, or according to the size of the iron operated upon. It is then suffered to cool, the surface is cleaned, and Mr. Reid asserts that a coat impervious to rust is formed. If this is verified by positive experiments, the cheapness and simplicity of the plan deserve to be widely known. Mr. Joseph Poleux, of New York, communicates, in the same year, a plan to overcome oxidation. He employs muriatic acid, nitric, or sulphuric acid, of the ordinary degrees of concentration in commerce, without dilution, combined with the introduction of spelter into the cleansing process. In 1857, Mr. G. Bedson patented a new process. He melts a quantity of pitch derived from mineral tar, and a proportion of tar oil, with caoutchouc tempered with tar oil and shellac, the substance to be solid and elastic when cold. Mr. C. F. L. Oudry claims depositing copper on a preservative or intermediate coating instead of on the metal. He deposits copper in a pure state to any thickness on all metals. Mr. C. Iles, in 1857, de-

scribed a means of applying earthy cements to metals. In 1858, Mr. J. Coutts received a patent for applying the following pigment by heated air :—

Carbonate of baryta	·650
Litharge	·065
Arsenious acid...	·030
Asphaltum	·050
Oxide of Calcium	·030
Creosote (oil of tar)	·175

Perhaps the most novel introduction is that patented here by Messrs. Bouchard and Clavel, the Paris bankers, in 1858. On the estate of La Gruerie, in Charney, Department of Yonne, France, is found an earth of the ochre description, called "Burgundy Red." This earth contains most valuable properties, and is said to be an exceedingly good preservative against rust. It is used as a cement and paint by admixture with the following :—

Burgundy red	66 parts
Grease or oil	15 ,,
Lime	11 ,,
Unburnt earthenware, chalk, or Roman cement...	8 ,,
	100 ,,

This is said to prevent oxidation if the earth is merely diluted with volatile oil. D. M'Crae, in 1858, was allowed a patent for preserving bottoms of ships from fouling or decay. He applies grease from the cells of boiled bones, kitchen stuff, and butter without salt; a poisonous matter is mixed with these fatty substances. Mr. G. P. Lock, in 1858, made a composition for the under-coating of iron ships, made from iron ore ground in boiled linseed oil 50 per cent., oil of turpentine 50 per cent., well mixed. For the outer coatings, white lead 40 per cent., blue mineral or copperas 10 per cent., and oil of turpentine 50 per cent. In 1859, Mr. Henry, on the part of Moisant and Co., sought protection for bituminous products and compounds of bitumen for preventing oxidation. Mr. T. J. Laballe, made a preparation of caoutchouc paints and colours for vulcanising. Mr. J. Crawford, of Liverpool, in 1859, applied for a patent for a metallic paint or varnish, composed of plumbago, or black-lead, fine or gum varnish, arsenic, and spirits of turpentine mixed. Mr. F. W. Emerson, in 1859, prepared an anti-corrosive paint from oxi-chloride of lead, mixed and ground with oil, turpentine, varnish, or other vehicle. Mr. Weild, in 1859, sought to economise time and labour by a mechanical machine for applying paints to metals on large surfaces. Mr. James Meikle, in 1859, proposed coating iron ships with asphalte. In the same year, M. Auguste Pin dissolved sugar in muriate of zinc, then added wax and soap, in which was incorporated calcareous stones, phosphate of soda, sulphate of zinc, and copper, and the syrup of potatoes or sugar, with powdered marble, quartz, or felspar.

In 1859, Mr. F. G. Spilsbury, of Louvain, applied for a patent for the manufacture of a paint. He took sulphate of lead, and heated it to a red heat, either by itself or mixed with alumina or other earths; the pigment thus obtained to be washed first with sulphuric acid, then with water, when it is finally dried. Previous to drying the pigments they are digested with salts of tungstic acid, molybdic acid, titanic acid, tantalic acid, arsenic acid, acid of antimony, or other metallic acid, or with mixture of the above salts. A combination between the sulphate of lead and the metallic acid or acids is obtained, and the resulting pigments are dried in like manner after having been cleared from all adhering salts. The pigments may then be mixed with oil and used as a substitute for white lead. Mr. J. F. J. Lecocq, in 1860, prepared a calcareous varnish for coating iron and the bottom of ships. Mr. H. Kemp, in 1860, patented a composition consisting of peat, tar, wood tar, methylated spirit, peat oil, or linseed oil, arsenic resin, and carburet of iron, for preserving ships' bottoms. Mr. Allen's plan of making a coating or anti-corrosive paint for metals is thus given :—Ammoniacal liquid obtained from coal tar, or gas tar, prevents incrustation in boilers, and is applicable to painting the inside plates. Messrs. Pile and Symth, of West Hartlepool, took out a patent in 1860. They employ a red composition and enamel, consisting of a combination of litharge, Venetian red, and pine varnish. Over this composition is applied a coating of resin, gums, or any pitch or bituminous substance, with the addition of coal tar, or oil. This is put on in a hot lava state, and the process is called enamelling. An impermeable oil varnish was patented by M. Antoine Bonet in 1860, composed of 100 parts of alcohol, 100 parts of spirits of turpentine, one part of sulphuric ether, and one of carbonate of soda.

Mr. Robert Smith, shipowner, of Finsbury, applied to the Patent-office, in 1860, to protect his system for keeping vessels from fouling and worming. He applies equal parts of pitch, tar, resin, and turpentine, with any other adhesive compound. Assafœtida to be mixed with the foregoing, as a poison to destroy life. When the coating is laid on, and dry, the whole to be covered with paper or cloth. Mr. G. Hallett, in 1860, in his patent explains his method of protecting metal. He grinds the oxide of antimony to powder, then dries it, and mixes with it 12 lbs. of linseed oil to the hundredweight of powdered oxide. Mr. Richardson, in 1861, to prevent oxidation, would cover the metal with vulcanised india rubber, cloth, or gutta percha, the object sought being to provide for unequal expansion of the metal and coating. Mr. Francis Pulz, chemist, in 1861, causes oxygen to be passed through sulphuric acid, to render the oxygen more active as an oxidizing agent, as it combines, when so treated, with other substances for which it has an affinity, for manufacturing purposes. Mr. Pulz, also, in a second patent, submits oily matters to this oxidising agency, by causing the sulphuretted gas to pass through them when in a liquid state. Mr. Martin Miller sends a communication, in 1861, for coating metals by metals or alloys in different ways. Mr. John Hay, in 1861, patented a drying oil. He lays a non-conducting coat, and then makes a paint by grinding in linseed oil the black or protoxide of copper, which is then boiled till reduced to the sub-oxide, and by thus oxygenating the oil he claims to have formed a quick drying cupreous oil. Mr. John Snider, of the United States, patented here a compound, in 1861, for coating metal. He reduces amorphous graphite to fine powder, and then mixes it with ore by the agency of a heated steam pipe. When cool and dry, one pound of oil is added to three pounds of the powder, and when the ingredients are combined, hot pure beeswax, in the proportion of one pound of wax to 10 lbs. of graphite, is mixed. Afterwards linseed oil may be added. Mr. Snider details his manner of manipulating and preparing the graphite and ore. Messrs. Hallett and Stenhouse, in 1861, obtained a patent for the manufacture of pigments for coating surfaces. They employ native oxide of antimony, chemically treated in ways too intricate for explanation in this abbreviated outline, and mixed with red lead or litharge. They sometimes take type metal or worn-out types, reduce them to a coarse powder, and then mix them with their own weight of zinc, and calcine them. This produces a yellow pigment.

CORNISH PUMPING ENGINES.

At the meeting of the Institution of Civil Engineers, held on Tuesday last—J. R. McClean, Esq., Vice-President, in the chair—Mr. W. Morshead, jun., read a Paper on the "Duty of the Cornish Pumping Engines."

It appeared from a tabular statement prepared by the proprietor of "Lean's Engine Reporter," for the years 1841 to 1860 inclusive, that the average duty of these engines had fallen off from 68 millions in 1844 to 52 millions, in 1860, or 25 per cent.; also that less interest was now felt in the performance of these engines, as while fifty were reported in 1841, only fifteen were reported in 1858, and twenty-five in 1860. Although the nominal, or reported duty, showed this marked diminution, it was not asserted that there had been an actual falling off to the extent thus indicated—for the duty paper did not take into account the quality of the coal, which was certainly inferior to that used twenty years ago; besides which the present practice of sinking the engine shaft, for the whole, or part of its depth, in an inclined direction upon the course of the lode, must have tended to increase the friction of the pitwork, and the mines were also deeper than formerly. Nor was expansion of steam adopted to so great an extent now as it was some years ago; it was then carried further than was compatible with safety, as was evidenced by the repeated breakages of the main rod, the piston rod, and the other principal parts of the engine. But after allowing for all these legitimate causes of the falling off of duty, it was thought that the average duty of the county was still at least ten millions below what it should be.

The author next examined the causes of this decline, and then discussed the means by which it might be remedied. The primary cause he believed to be, the indifference of the mine proprietors to the performances of the engines. So many accidents attended the use of high steam, cut off at an early part of the stroke, that economy of fuel came to be regarded as synonymous with repeated breakages; but it was quite possible to raise the duty considerably above the present average, without resorting to an undue rate of expansion. This might be accomplished by a more perfect and extended system of reporting the engines, and by a new form of duty paper, embracing the following additional items :—First, that the load upon the piston should be taken from an indicator diagram, and from the load thus ascertained the duty should be computed, the difference between the load upon the piston and the weight of water actually lifted—that was, the loss by the friction of the pitwork, &c.—being placed in a separate column. Secondly, that the part of the stroke at which the steam was cut off as well as the vacuum obtained, should be stated opposite each engine. Thirdly, that a notice of the quality of the coal used, as far as it could be ascertained, should be added. And lastly, that the engines should be separated into two classes—those which might reasonably be expected to give a good duty, and those which, from the time they had been at work, their small size, or other causes, could not fairly compete with the former. By taking the load upon the piston from an indicator diagram, a fair estimate of the work actually done by the engine could be formed, while by placing the difference between the load upon the piston and the weight of water actually lifted in a separate column, encouragement was offered for improvement in the construction and fixing of the pitwork.

At present, only about one-tenth of the engine at work in Devon and Cornwall appeared in the monthly reports. If mine proprietors would co-operate in supporting a good form of duty paper, there was little doubt, but that there would be a rapid and marked improvement in the duty of the Cornish engines.

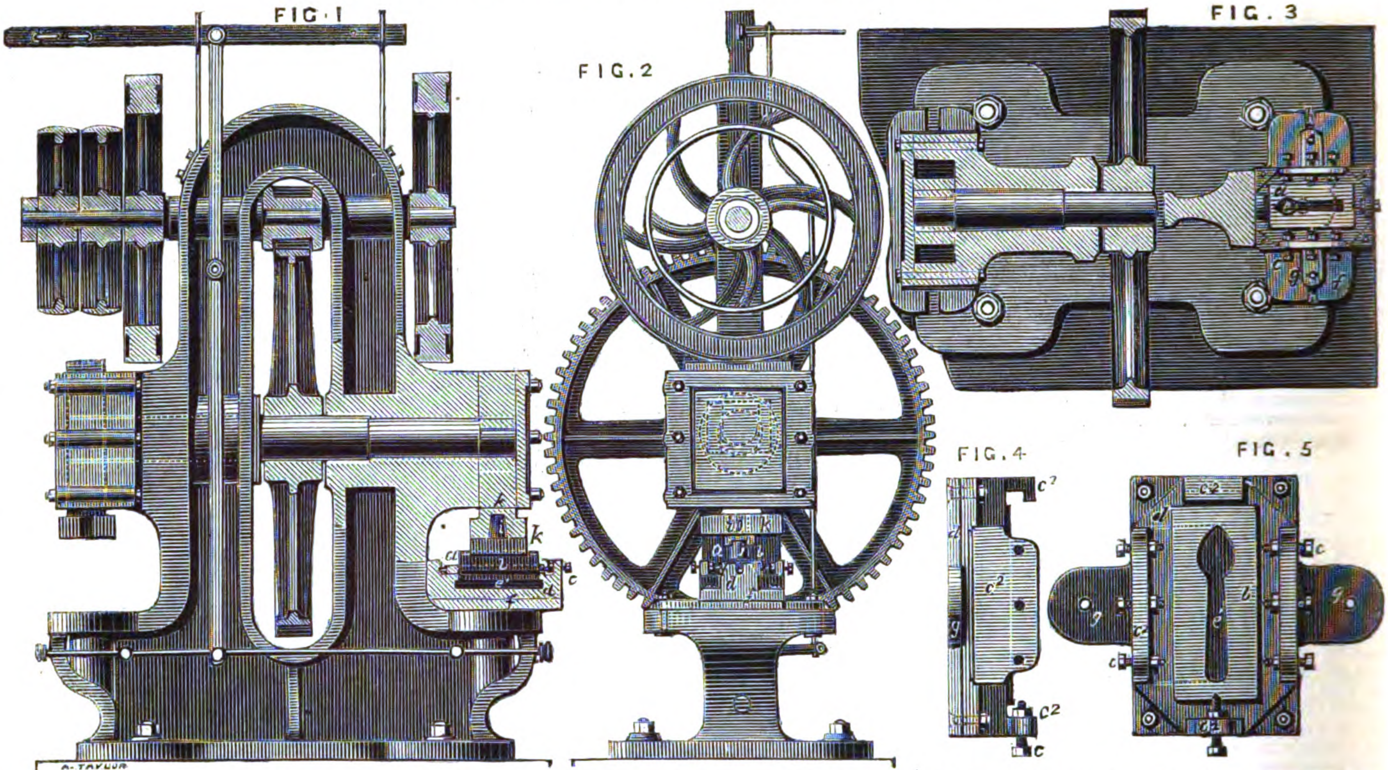
NADAR'S GREAT BALLOON.

The "Géant," now at the Crystal Palace, is by far the largest balloon ever yet made. Its entire height, including the "compensator"—a small balloon under the large one, containing a reserve of condensed gas—and the car, is close upon 200 feet, and when fully inflated it will contain 215,363 cubic feet of gas. For greater security it has two skins, both of white silk—the outer coloured a yellowish white—of the finest quality, and of which more than 20,000 yards were consumed in the manufacture. All the gores are entirely hand-sewn, and the work occupied 300 men and women for more than a month. Perhaps we shall give the best idea of its magnitude to English readers, by saying that it could not be got into one of Captain Fowke's great domes. It is easy to understand, too, how hard it must be to control this enormous body of gas so as to manage a safe descent; and novices in aëronautics may be permitted to doubt whether, until the valve machinery is improved, safe voyages can be performed by balloons of such a size. M. Nadar himself, attributes the unfortunate issue of his last trip more to the deficiencies of the valves, which did not permit the gas to escape with sufficient rapidity, than to the failure of the anchors. The "Géant" is calculated to lift $4\frac{1}{2}$ tons.

The car is a great curiosity in its way. In its outside appearance it is not unlike, on a small scale, one of the caravans to be met with by the side of a gipsy encampment. It is about 15 ft. long, by 12 wide, and is partitioned off into a captain's cabin with sleeping berth, four small cabins with berth, washing room, and printing and photographic operating rooms. It is fitted with wheels on moveable axles, so that there may be no difficulty in the return, supposing a descent to be effected far from the ordinary means of transport. There are windows and doors on each side; but, after all, there does not seem much room for nine people to turn in comfortably. For those who prefer the open air there is the roof, with which a strong high bulwark running round makes a kind of airy terrace or quarter-deck.

We are informed that a substitute for cotton has been discovered by a firm in Liverpool, with which length of fibre, delicacy, elasticity, and great strength, are equal, at least, to Indian cotton. It can be produced to any amount at 6d. per lb. It has been patented in France; and its applicability and utility are so evident, that the Minister of the Interior has intimated his intention of forwarding its use by all means in his power.

BROOMAN'S IMPROVEMENTS IN THE MANUFACTURE OF SPOONS AND FORKS.



BROOMAN'S IMPROVEMENTS IN THE MANUFACTURE OF SPOONS AND FORKS.

THIS invention, patented by Mr. R. A. Brooman, of Fleet-street, relates to the manufacture of spoons and forks from sheet metal, as hereafter described. The patentee uses an ordinary cutting-out or stamping press, on the bed of which are placed matrices, corresponding stamps or dies being fitted in the head. These matrices and stamps are changed according to the progress of the work or the particular part of the work to be performed.

The patentee first takes a frame and adjusts therein a matrix, in one or more pieces, of the contour of the spoon or fork to be made. This is placed on a counter-matrix, in which there is an inclined channel for receiving and leading away the piece of metal stamped from the sheet, as hereafter explained, and the frame is fixed on the bed of the press. A stamp or punch corresponding with the matrix is fixed in the head of the press. Sheet metal being placed on the matrix and the stamp or punch brought down, a blank, having the outline of a spoon or fork, is cut or stamped out, which falling through the inclined channel is removed for the second operation; which consists in turning up, in a matrix and stamp for the purpose, side-pieces between the part for forming the bowl or prongs and the handle. The third operation consists in turning down and consolidating the side-pieces so raised by another matrix and stamp; while the fourth operation consists in hollowing out the part intended for the bowl or for the prongs by means of a matrix and stamp constructed and shaped for such purpose. The fifth and last operation, for giving the finished shape to the article, is performed in a matrix and stamp prepared for that purpose.

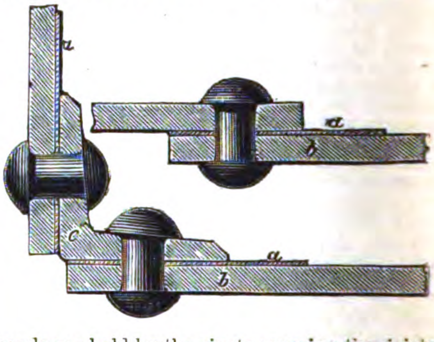
Fig. 1 of the accompanying drawings is a longtitudinal section, fig. 2 an end view, and fig. 3 a plan, of an ordinary cutting-out or stamping press suitable for carrying this invention into effect. a is a matrix, which is placed on a counter-matrix b, and fixed by screws c, c, passing through lugs c_2 of a frame d. The matrix a may be in one piece or in two pieces. The counter-matrix b is formed with an opening e^1 corresponding with the opening e of the matrix a; the opening e^1 is continued downwards in the form of an inclined channel for receiving and leading away the piece of metal stamped from the sheet. The frame carrying the matrix and counter-matrix is fixed on the bed f of the press (figs. 1, 2, and 3) by means of screws or bolts passing through lugs g, g, fig. 5, into slots h of the bed. i is a stamp or punch carrier fitted in the head k of the press, and receives in its dovetail a stamp or punch of a shape corresponding to the spoon or fork blank to be cut or stamped out. When a spoon or fork blank is cut or stamped out, it falls through the inclined channel e^1 into a receptacle placed to receive it. The next operation is to shape the spoon or fork to the form required by turning up side-pieces o, o. This is performed by substituting a second matrix for the one on the bed of the press, and a different punch for the stamp or punch represented, and by bringing down the stamp or punch as before. The third operation consists in turning down and consolidating the side-pieces by another matrix or punch. The three operations above described may be performed in the press (figs. 1, 2, and 3) by simply changing the matrices and stamps. The fourth and concluding operations are performed in the same way by changing the punches and matrices, or by the aid of a separate fly-press.

WILDE'S IMPROVEMENTS IN THE CONSTRUCTION OF STEAM BOILERS.

THE nature of this invention, by Henry Wilde, engineer, Manchester, consists in a method of constructing steam boilers by which the peculiar kind of corrosion, known as furrowing, is greatly diminished or entirely prevented.

It is well known that this furrowing occurs in the immediate vicinity of a seam of rivets, and near the edges of the angle iron which joins the ends to the shell of the boiler, and also in other parts where one piece of iron in a state of vibration and tension is in contact with another piece, either in its normal condition or in an unequal state of vibration and tension.

In constructing boilers according to these improvements a fillet or band of thin sheet copper or other suitable metal, marked a, having holes punched through it corresponding with those in the boiler plates b, b, is placed between the plates b and the angle iron c, and between the end plate d and angle iron c, and also between the plates where they overlap each other to form the transverse and longitudinal seams. The fillets or



bands are held by the rivets securing the joints, and they are of sufficient width to extend beyond the joints in the interior of the boiler, and to overlap or cover those parts of the plates where the furrows are usually formed.

Instead of placing a fillet of copper or other suitable metal between the plates, as above described, the boiler plates may be coated with copper or its alloys by any of the well-known methods for the purpose of producing the same result.

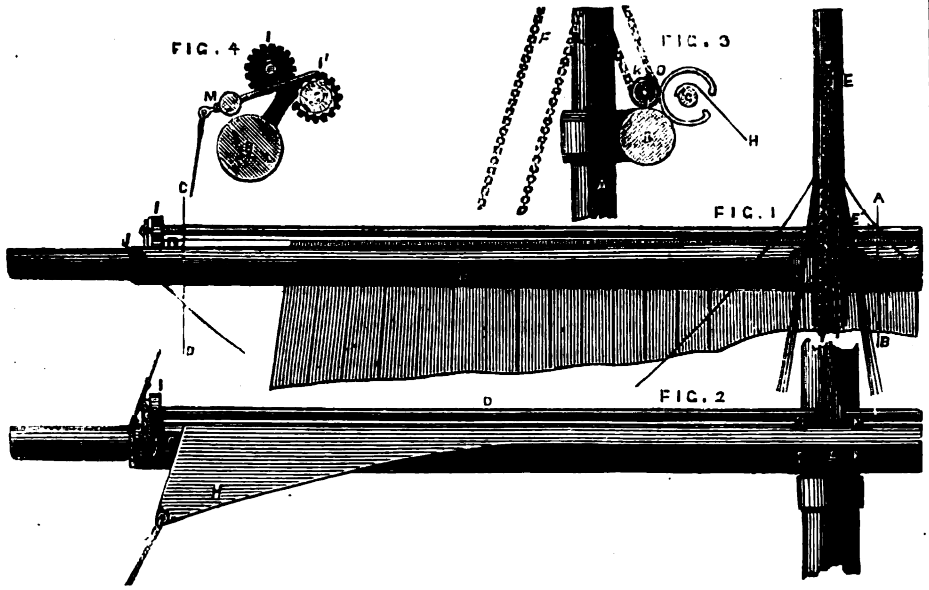
The above improvements are also applicable to boilers made of steel plates.

WILLETT'S IMPROVEMENTS IN REEFING SAILS.

THIS invention, patented by Captain Willett, London, has for its object a very simple but most efficient arrangement for furling or reefing top or square sails from the decks. It can be adapted to the square sails of any ships, and does not require the sail to be in any way altered or divided, as is required in many of the existing reefing apparatus.

Its simplicity of construction renders it much cheaper, and at the same time less liable to get out of order.

WILLETT'S IMPROVEMENTS IN REEFING SAILS.



The sail is bent to a wooden roller secured on the fore part of the yard by suitable bearings at each end, and supported in the centre by a roller claw firmly secured to the mast, and of sufficient size to receive the entire sail when wound up on the roller spar. A solid or hollow metal rod of equal length to the roller spar is secured, and turns in suitable bearings fixed near the ends of the yard, and forming part of or closely connected with those in which the roller spar turns. Each end of the metal roller is furnished with a cog wheel, which gears with a similar wheel on the ends of the roller spar. On the centre of the metal roller is a chain wheel, grooved similar to the chain wheel of a clock, for the purpose of forming a secure hold for a chain, which, after passing over it, is led through two sheaves fixed in the mast, one a short distance above the other, but both higher up in the mast than the yard would be if the sail was set. The chain is of sufficient length to permit the furling and unfurling of the sail; and the two ends are attached to two haliards, by which the apparatus is worked from the deck. Thus when the sail is set, by slackening away the upper haliards, the yard will descend from its own weight, and the metal rod will be put in motion by the slackening of the chain, and communicate its rotary movement to the roller spar by means of the cog wheels, and so reef the sail to any size required. By tightening the upper haliards the sail is set. The above description will be readily understood by aid of the accompanying drawings.

Fig. 1 is a back view of the sail; fig. 2 is a front view, showing the yard supporting the roller spar, with the sail nearly furled; fig. 3 is a sectional side view, showing the chain wheel over which the chain passes, and the roller claw; fig. 4 is an enlarged sectional view (following the line C, D,) of the cog wheels on the metal rod and the roller spar, and also the bearings which support the ends of the metal rod and roller spar.

A represents the mast; B, the yard supporting the roller spar C, to which the sail H is bent; D is the metal rod, in the centre of which is fixed the chain wheel K; E and E^1 represent the upper and lower sheaves over which the chain F passes; F, the chain, which after passing over the lower sheave E^1, is passed round the chain wheel K, and then over the upper sheave E; the chain F, on leaving the chain wheel, is made to pass up the side of the mast, slightly hollowed out for the purpose; G, the haliards attached to the ends of the chain F, and descending to the decks; H, the sail; I and I^1, cog wheels on the metal rod D, gearing with the cog wheels J and J^1 on the roller spar; K, chain wheel on the metal rod D, and put in motion by means of the chain F, worked by the haliards from the deck; L, claw furnished with friction rollers, and serving as support to the roller spar on which the sail is bent; M, self-acting paul for the purpose of holding the roller in case of accident. Both the cog wheels and the paul, should one be made use of, may be boxed over as a protection, and to prevent ropes from entangling in them.

MAKING HORSE-SHOES BY MACHINERY.

Although this branch of trade makes small progress in England, it appears to be carried on with some success in the American States. Horse-shoes are now manufactured in large quantities at Providence, R.I., and at Troy, N.Y., the machines, however, being entirely different in construction at the two places. At Providence the shoes are all made from scrap iron, fagoted up, welded together, and afterwards rolled into long rods. These rods are creased for the nail-hole in passing through the rolls, and afterwards punched complete in one operation—eight holes being made in each one. The shoes are bent into shape by a peculiar apparatus, and hammered by a trip-hammer while in the machine, so that they do not spring when taken out or alter in shape. It was a matter of great doubt among mechanics at one time whether horse-shoes could be made by machinery to equal those produced by hand-labour; but, we believe, all apprehension on this score is set at rest, and that machine-made shoes are in all respects as good as those made in the old-fashioned way. The Providence factory is now running night and day, turning out 200 tons per month for Government use.

NEW MODE OF FIRING MINES BY ELECTRICITY.

This new fuse, invented by MM. Comte and Gaiffe, which will, it is hoped, render incalculable service in the working of mines and the excavation of tunnels, differs from those which have been employed hitherto, in a novel arrangement of the parts of which it consists, which permits of its manufacture in a very short space of time, and reduces the chances of fracture to a minimum. It consists, first, of an insulated wire, to which is affixed the usual fuse tube; secondly, of another wire, uninsulated, twisted round the first, with its extremity removed one centimetre from that of the insulated wire; and lastly, of a bag containing the explosive compound, within which are buried the extremities of both wires. When the induced current from a Rumkorff coil is passed through the wires, the spark, on account of the distance which separates them, passes through the powder contained in the bag. The thread of tin which is employed to complete the circuit in the first instance, is melted instantaneously, and a considerable space then exists between the insulated and the uninsulated wires, through which the spark passes. By this arrangement, it is possible to affix upon two wires proceeding from the coil as many fuses as may be thought fit. The current having passed through the first proceeds to the second; from that to the third, and so on; and because the sparks from Rumkorff's coil succeed one another with great velocity, a great number of mines can be exploded almost instantaneously. So far, the invention has been pronounced by the French press perfectly successful, the experiments which have been made leaving nothing to be desired.

RAILWAY BRIDGE ACROSS THE TIBER.

The *Journal of Rome*, for one of the last days in October, contains the following:—"Yesterday the Pope visited the works now being carried out on the new iron swivel bridge across the Tiber, which is intended to carry the railway from Civita Vecchia to the Central Station within the walls of Rome. His Holiness proceeded to the bridge on foot, and attentively examined all the details. He willingly assisted at the manœuvre of opening one-half the colossal structure, to permit the passage of some sailing ships and steamers. The operation was executed with remarkable care and expedition. Two steamboats, proceeding in contrary directions, passed through without difficulty at the same time. His Holiness made some complimentary remarks to the engineers, and returned to the Vatican." The bridge in question is the first of the new "suspended" bridges invented by M. Alphonse Oudry; in which the cables are so disposed that oscillation is completely obviated. It is said that an eminent engineer has conceived the gigantic project of throwing one of these structures across the straits between Reggio and Messina, and, subsequently, should this scheme succeed so far, to put England and France in direct communication by similar means.

RUSSIAN PREPARATIONS FOR WAR.

From whatever source the Emperor's apprehensions arise, he appears determined to prepare for the worst. Cronstadt is being strengthened under the superintendence of General Todtleben and General Zareva, by placing the old forts in a better state of defence, and at many points covering up the masonry by earthworks. On the main island of Cronstadt, seaward, large earthworks are being thrown up, some of which are nearly finished. Some of these earthworks, more exposed than others, are to be covered with 7½-inch plates, placed on an angle of 45 deg., and curved over the top, so as to form a cover from vertical fire, and at the same time obviate the necessity of having bolts or any other fastenings to retain the plates in position. The embrasures will be closed immediately the gun is fired by a slide of 11-inch iron, or by a drop door. The guns to be placed in those iron-clad and other earthworks, are to be 9-inch rifled cast steel, carrying a 300lb. rifled shot, or a 250lb. shell, 22 inches long.

Another means of defence is also in course of preparation—a submarine boat of colossal dimensions, in the construction of which about 200 tons of iron and steel are to be used. It is rapidly progressing towards completion. Great secrecy is being used about this boat. Nevertheless, the *Times* states authoritatively that it is to have engines worked by compressed air, to have a very strong beak, with provision for attaching large cylinders charged with powder to the bottoms of vessels, to be fired by electricity. The parties navigating the vessel will see what they are doing by means of bulls'-eyes, and they will be able to regulate the depth at which they swim, generally keeping quite close to the surface. The Emperor has not only approved the plans, but some months since signed the decree appropriating about £27,000 for this monster.

The utmost activity prevails in the Ordnance Department; Krupp has his hands nearly full in preparing a supply of steel guns of the largest size. The authorities are erecting a mill at Colpino, near St. Petersburg, and propose to have a second mill built at once, that they may be able to produce 10,000 to 12,00 tons of armour-plates per year. Stirring times these for the Continental engineers!

The armour-plated frigate "Sebastopol" has just been launched at Cronstadt with success. She is to carry engines of 1,000-horse power, and will be armed with 38 rifled guns. The "Sebastopol" is covered with iron plates throughout. On the slip from which she has just been launched another vessel of the same rank, to be called the "Emperor Nicholas," is soon to be laid down, and will, it is expected, be ready for launching in the spring.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—W. and H.—W. B.—H. E.—G. C.—J. N.—W. B.—W. W.—J. H.

S. B. (Belfast).—Use 11-16th rivets spaced 2 in. apart from centre to centre.

Buer (Minories).—Use a pound of good copper and one ounce of tin. If this is too expensive, try 20 oz. of copper, 10 oz. of zinc, 2 oz. of tin, and a little lead. This mixture should be melted twice before using it. It is suitable enough for coarse shafting at a slow speed under moderate pressure. It may be greatly improved by a mixture of old brass.

A Mining Engineer.—We must refer you to our advertising pages.

T. Y.—The only principle involved in the construction of hydro-carbon lamps, is the supply of the necessary quantity of oxygen to the flame by means of a deflector, the construction of which varies according to the ideas of different inventors.

Azote (Walthamstow).—We really cannot state what opinions on the subject of aërial navigation are held by the French engineering world. The Continental papers argue the question *pro* and *con*, at great length, with much acerbity.

Correspondence.

STRESS UPON BOILERS AND BOILER PLATES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—The strength and uniform thickness of boiler plates are usually determined upon the assumption that, from the pressure of the steam upon the surfaces, there are two strains acting upon the metal forming the cylinder—one in the direction of the length of the boiler, from the pressure of the steam upon the circular ends; the other from the pressure of the steam upon the concave surface of the cylinder, in the direction of the radius, tending to split the boiler into two equal parts in opposite lines, at the extremities of a diameter in the cylinder parallel to the axis of the boiler, which latter strain is manifest, supposing the boiler metal to be perfectly rigid and inelastic.

But since metal plates are not perfectly rigid and inelastic—being, though the elasticity be but small, imperfectly elastic—it may, perhaps, be of some use to consider whether a third force, acting in the direction of the radius as before, ought not to be taken into account in determining the form and the thickness of the plates, which force, as it so appears, has a *tendency to change the cylindrical form of the boiler;* the greatest diameter, strain, tension, and compression of the metal being at the middle of the length of the boiler. The amount and effect of the stress referred to will more plainly appear by the following example:—

Suppose a boiler to be 240 in. long, 42 in. diameter, 132 in. circumference, pressure of the steam 40 lbs. per square inch, then the pressures and strains upon the surfaces and the metal plates will be as follows:—

Stress upon the boiler in the direction of the length of the boiler, from the pressure upon the circular ends,

$42 \times 42 \times \cdot7854 \times 40 = 55,417\cdot8$ lbs. ....(1)

Stress upon the internal surface of the cylinder in the direction of the radius perpendicular to the surface of the boiler,

$240 \times 132 \times 40 = 1,267,200$ lbs.........................(2)

Stress to split the boiler into two equal parts in opposite lines in the circumference of the cylinder, parallel to the axis of the boiler, from the last-named pressure (2),

$240 \times 42 \times 40 = 403,200$ lbs............................(3)

The strains (1), (2), and (3) are nearly as the numbers 44, 1,000, and 318 respectively, strains (1) and (3)—or, being the greatest, strain (1) only—being those by which the thicknesses of boiler plates are usually determined.

Suppose the circumference of the cylinder to be divided into 132 equal parts, forming, say, a polygon of 132 equal sides, each side being 1 in., or nearly so, in width; and suppose, also, one of these sides to be detached and fixed in a horizontal position, we should then have a strip or bar of metal 240 in. long clear of the supports, 1 in. in width by the thickness of the plate; then, taking the strains as they are in the boiler, the stress upon the metal bar, in *three* directions, will be as follows:—

Strain in the direction of the length,

$\frac{55,417\cdot8}{132} = 419\cdot83$ lbs. ....(4)

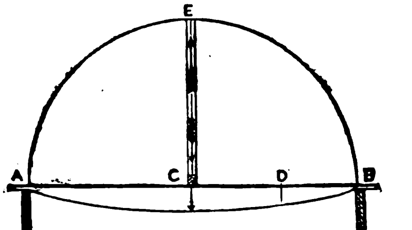
Transverse strain upon every inch in length, at right angles to the last strain,

$\frac{403,200}{2 \times 240} = 840$ lbs...(5)

Vertical pressure, 40 lbs. upon every inch in length, $240 \times 40 = 9,600$ lbs. ....(6)

The strains (4), (5), and (6) are as the numbers 1, 2, and 22·86 respectively.

Let A B represent the metal bar, 240 in. long; bisect A B in C, then the stress at C, from the vertical pressure 40 lbs. upon every inch in length will be 4,800 lbs., and the stress upon the bar and upon the boiler at 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 ft. from the ends A and B, will be as the numbers 19, 36, 51, 64, 75, 84, 91, 96, 99, and 100 respectively. The stress at C, 10 ft. from the ends, being 4,800 lbs., the stress at 1 ft. from the ends will be $\frac{19}{100} \times 4,800 = 912$ lbs.; at 2 ft., $\cdot36 \times 4,800 = 1,728$ lbs.; at 3 ft., $\cdot51 \times 4,800 = 2,448$ lbs., about one-fourth of the uniform pressure; and so on, at other distances. If the thickness of the metal Dc, at any point D, in A B, varied as the square root of the rectangle $A D \times D B$, or at 1, 2, 3, 4,......10 ft. from the ends as the square roots of the numbers 19, 36, 51, 64,......100, or as 4·36, 6, 7·14, 8,...and 10 respectively, then the strength of the metal plate A B, to resist the uniform pressure, 9,600 lbs., would be everywhere proportioned to the stress; and the boiler, from that one force alone, would no sooner burst in one place than in another. If the metal, instead of being curved, were of a uniform thickness, the mechanical rule, "the strength as the stress," might be approximated by circular bands or hoops surrounding the plates, increasing in strength, at intervals, from O, at the ends A and B, to 1, at the middle of the boiler at C. At the middle point C of the metal bar, instead of one force only, we have three forces, acting at right angles one to another, as before stated, namely—



Stress at C, in the direction of the length A B	419·83 lbs. (7.)
Stress at C, upon one inch in length, at right angles to A B	840 lbs. (8).
Vertical Stress at C	4,800 lbs. (9.)

The strains (7), (8), and (9) are as the numbers 1, 2, and 11·43 respectively. Query—Are there any published experiments upon metal subjected to two strains, and to three strains; and if so, what are the results, supposing the strains to act upon the metal simultaneously and separately?

Suppose the boiler to be cut by an horizontal plane through the axis dividing the same into two equal parts, the plane or plate resting upon the two parellel edges of the lower one-half of the boiler, as in the figure: A B = 3 ft. 6 in., representing, in this case, the width of the boiler.

Let a metal bar, 240 in. long, 1 in. in width, weighing 40 lbs every inch in length, be placed at C, the middle of the plate, parallel with the edges of the cylinder, then the stress upon the edges of the cylinder, at A and B, from the weight at C, will be the same as from the pressure of the steam at E; and the effect, from the weight of the bar at C, on the beam or plate, 20 ft. wide, 3 ft. 6 in. long, will be similar to the effect from the pressure of the steam upon the boiler at E, the effect from the former being to deflect and break the beam or plate A B at C, and the effect from the latter being to expand and burst the boiler at E, and, in like manner, at the remaining 131 sides of the polygon. The effect from the latter pressure might be shown in a model, by connecting two circular wood plates by an axle, covering the same with some flexible material, secured to the circular plates, and subjecting the same to atmospheric or other internal, pressure.

In connection with this subject, and in conclusion it may be remarked that in mixing metals if the tension *plus* the compression of the metal, within the elastic limits, be a given quantity, that metal will be the strongest possible in which the strength in tension is equal to the strength in compression, the neutral axis being in that case at the middle of the depth—this would be the best position of the neutral axis, if the metal, as in the weight upon a beam, were subject to one stress only; but if the metal, as in a boiler, be subject to two strains (both in tension) or to three strains (two in tension, one in tension and compression), the position of the neutral axis, for the metal to be of the greatest strength, would vary according to the strains upon the metal beam or plate.

I am, Sir, your obedient servant,

William Lea, Surveyor.

3, Highgate-place, Birmingham, Nov. 16, 1863.

VENTILATING SHIPS.

Sir,—Perceiving that you are giving a summary of the means which have been, from time to time, proposed for the prevention of decay or dry-rot in timber-ships, I beg to call your attention to a plan which I have lately introduced in connection with ventilation, and which, I think, will be found very effectual, besides serving another very important purpose, that of preventing or removing all foul smells from ships, and effecting a thorough ventilation of all the ships' timbers, as well as of the inhabited deck. The leading feature of my (patent) system is the conversion of *all* the timber spaces or openings into branch air channels of an air shaft on each side of the ship, having apertures of communication of regulated size between it and them. This longitudinal air-shaft, on each side, is communicated into the funnel in steamers by a cross-shaft, or into tube and cowl ventilators in sailing vessels used as uptakes. Thus it will be seen that by this means a circulation of air takes place through the whole framework of the ship, drawn from the passenger deck through the openings above the shelf piece, and from the bilges through all the lower outlets of the timber spaces; the foul air from the bilges and hold—if with such a constant circulation it can continue foul—is vented clear of the ship, instead of polluting the air of the mess deck as at present. This plan has been carried out under my superintendence, by order of the Lords Commissioners of the Admiralty, in the "Royal Sovereign"—steam cupola ship—and a very slight increase of temperature in the funnel draws a current of air through this extensive system of air-shafts and natural channels sufficient nearly to extinguish a candle in the two main shafts, each of which is 18in. by 8in.; of course, when the fires are lighted it would be infinitely increased. When it is considered what extensive timber surfaces are contained in these "timber spaces" thus made by a simple contrivance branch and channels of an active ventilating system, the importance of the circulation thus established becomes manifest; the passive circulation hitherto taking place through them was notoriously inadequate to prevent dry-rot or dampness, which, with insufficient ventilation, to the cause of dry-rot.

I am, Sir, your obedient servant,

Henry Edmonds, M.D.,

Staff Surgeon, Royal Navy.

Portsmouth, Nov. 16.

STEAM FIRE-ENGINES.

Sir,—We will thank you to allow us to correct an error in Mr. Roberts' Paper on Steam Fire-Engines, which was published in your journal a week or two since.

The pumps of our "Sutherland," first-prize steam fire-engine, were *not* "primed" or charged at any time during the Crystal Palace trials, nor have they ever been primed.

The Committee remark thus of this engine in their report, "*pumps not primed.*"

We are, Sir, yours respectfully,

Merryweather & Son.

Meetings for the Week.

Mon.—*Medical Soc.*, Lettsomian Lecture at 8.30 p.m.
Royal Geographical Soc., 1, Communication from Mr. Tinné, relating to "Explorations on the River District West of the White Nile." 2, "Journey of Colonel Pelly on the Shores of the Persian Gulf." at 8.30 p.m.
Tues.—*Inst. Civil Engineers*, Discussion on "Cornish Pumping Engines," at 8 p.m.
Thur.—*Antiquaries*, at 8 p.m.
Fri.—*Architectural Assoc.*, Discussion on Reports and Architectural Alliance. Also discussion on Mr. Darbishire's Paper on "Dwellings for the Working Classes."

Miscellanea.

The agent and superintendent of the Indus steam flotilla reports, on the 9th October, that the steamers and barges were actively engaged; five of the former, with attendant barges, having left Kotree with freight within eight days, another being ready to follow on the arrival of the English mail.

The proprietors of the "Great Eastern" have decided to make an effort to raise a further sum of £60,000, and to send the ship on a long voyage (to India or Australia), which, it is hoped, will prove more remunerative than the ruinous trips to New York.

A submarine cable, to connect Bristol and South Wales, has been successfully laid across the Bristol Channel at New Passage, by the British and Irish Magnetic Telegraph Company.

The shares in the Suez Canal Company have fallen to 375f., on account of two causes—first, a call of 50f. per share; and second, the Viceroy of Egypt having reduced the number of forced labourers from 25,000 to 6,000 men.

The manufacture of American watches, commenced within the last ten years in Boston as an experiment, has proved eminently successful. Unable heretofore to compete with the low-priced labour of European workmen, they perfected machinery by the aid of which watch movements are fabricated equal to the hand-made. The continued growth of this branch will diminish the importation of foreign watches, and may at no distant period earn for North America a reputation in this manufacture equal to that she enjoys in the kindred branches of clock-making. Gold and silver watch cases are now produced to a very large extent, chiefly in the cities of Philadelphia, New York, and Newark.

It is stated that the Viceroy of Egypt is importing steam ploughs on so large a scale as to tax the manufacturing capacity of England. He will soon have a capital of £200,000 in steam ploughs on his own estates alone, and is about to form a model farm on a large scale under the direction of an English agriculturist, where the work will be carried on with the most recent improvements used in England.

The foundation stone of a breakwater was laid on the 3rd inst. at the mouth of the river Tees. The breakwater is intended to extend seawards upwards of two miles, and when completed will form an admirable harbour of refuge during the prevalence of those easterly gales which annually rage on the north-east coast, causing immense destruction of valuable shipping property, accompanied with lamentable loss of life.

The Boston *Commercial Bulletin* says of the "Niagara":—This splendid vessel is now at anchor in the stream, and looks well; but she is altogether too deep, as she draws nearly 26 ft. of water—2 ft. more than the "Great Eastern," and 1 ft. more than the famous British iron-clad "Warrior.' Her main-deck ports do not seem to be more than 5 ft. from the water, and consequently, in a seaway, could not be opened with safety to use her best. battery. We have heard that she has not room enough to contain more than two and a-half months' stores for her crew, in consequence of the blunders of those sages in Washington, who designed the alterations in her. She was so deep when she had all the stores on board that some of her coal had to be taken out to lighten her. We have heard that she is bound to the Mediterranean, where she will be of as much use as if she was lying where she is—perhaps less, for here she might be used to protect the city. In the Mediterranean we require swift sloops of war and a gunboat or two, not a ship like the "Niagara."

The "Warrior" is undergoing a thorough examination in dock at Portsmouth. The *Times* says that many improvements have been recently made in the fittings of the vessel. Perhaps the one possessing the greatest novelty is the introduction of "ozone gas" into the engine-room and screw alley. Two small copper reservoirs, holding about a quart imperial measure each, contain a supply of spirituous oil which flows by a pipe, after the manner of a caged bird's water fountain, into a small copper enclosed tray filled with sponge. Through this a stream of atmospheric air is blown by a pipe from a pump (the latter set in motion by a weight and pulley), which, passing out by a discharge pipe at the opposite end of the tray, passes direct to the burners. There it gives out a beautiful white light, with comparatively no heat. An apparatus for the supply of a dozen burners may be carried under the arm. It requires no gasometer, and its use entails no danger to the ship. It emits no smell when burning, nor does the vapour itself, when allowed to escape unburnt from the nozzle of the burner. Its use entails no attention beyond the winding up, once in 24 hours, of the small weight which sets the machinery of the air-pump in motion. Its cost is one-fourth that of the candles served out for use from the paymaster's stores of the ship.

M. Jules Seguin has brought before the Parisian public a project for aerial locomotion between the Place de la Concorde and the Porte de la Muette, on Moreaud's system. According to this arrangement, the balloon will be held captive by means of a steel wire cable, running over vertical pulleys at the point of departure and arrival. These so-called pulleys are really large cylinders or drums on which the rope is wound backwards and forwards by means of a steam engine. To the cable which performs the functions of a locomotive, is fixed a line, which conducts the balloon; this is the general idea of a system on which Mr. Moreaud has experimented with great success, employing small balloons. M. Seguin proposes to carry 250 persons at each trip, from the Place de la Concorde to the Bois de Boulogne, or about 600,000 persons per year.

M. Polonze has laid before the Academy of Sciences, at its last meeting, a memoir on the Imperial Saltpetre Refinery at Lille, from the pen of M. Violette, *Commissaire des Poudres et Saltpetres.* This establishment is unique in France, and reflects great credit on M. Violette, by whom it was designed. It comprises a large storehouse or magazine, capable of containing three millions of kilogrammes of crude saltpetre; a refinery, from which half a million of kilogrammes of purified saltpetre can be turned out annually; a magazine, in which two hundred thousand kilogrammes of pure saltpetre can be stored with ease; and a cooperage, which supplies twelve thousand barrels yearly, in which products of the manufactory are packed. Iron tramroads form the means of communication all through the works. Water is distributed over the entire factory in pipes, through which it descends by its own weight from large tanks over the building. The rain water is collected in a cistern, holding 2,000 hectolitres. The products of combustion from all the furnaces unite in one immense chimney, wherein the draught is considerable. The gases escape at no higher temperature than 100 deg. Cent.; fair evidence of the complete utilization of the heat derived from the combustibles.

Our neighbours in France appear determined to follow up those magnificent schemes of inland communication by water inaugurated by M. Lesseps. Even a more gigantic project than the formation of Paris into a seaport is now said to be seriously contemplated. It is proposed to dig a canal which, starting from Marseilles, will join the Saone at Chalons, and thence form two branches. One of these branches is to be continued to Dunkirk, and the other to St. Naziere. M. Croy has published a pamphlet explaining the details.

One of the new 300-pounder guns intended for experiment on board the gunnery ship "Excellent" was on Monday mounted on its carriage and slide on the wharf at Woolwich for trial, in the presence of Brigadier-Gen. St. George, president, and the other members of the Ordnance Select Committee of Woolwich Arsenal. The breech of the gun is raised or depressed on Lieut. Roche's system. The apparatus is worked by a small pinion working into a rack formed on a hoop encircling the gun, and a quoin is thrust under the breech when a proper adjustment has been made. The trial appeared to be satisfactory, and the gun and fittings are to be forwarded by an early opportunity to Portsmouth. Mr. Parsons' breech-loading 6-pounder gun, which was satisfactorily proved a short time ago at Woolwich, underwent the same day a final trial at the proof-butt in the Royal Arsenal, in the presence of the Select Committee of Ordnance, by firing 100 rounds. The entire test occupied only 52½ minutes, including a delay which took place at the sixth round. The 94 rounds fired from that time were completed in 42 minutes, or one round in 30 seconds. Although, from the rapid firing, the gun at its termination was so hot that the hand could not touch it, the breech-action worked with perfect freedom, and maintained the breech quite gas-tight. Mr. Parsons suggests the adaptation of his plan to guns of larger calibre, as by it the sphere which serves the place of the vent-piece can be made of any size and strength necessary, as it has not to be lifted out of its place in the operation of loading. In a 110-pounder it may be made 800lbs. weight, and it will have corresponding strength. The slot necessary in the Armstrong gun is also dispensed with.

A Glasgow paper announces "for sale, by private bargain, the wonderful organ of James Watt, the illustrious inventor of steam, made by his own hands for his own amusement, in the city of Glasgow, nearly 100 years ago."

The new iron paddle steamer, "Will o' the Wisp," 600 tons, and 180 horse-power, was tried on Saturday, on the Clyde. The builders had engaged to carry 200 tons dead weight at the speed of 17 miles an hour, under a considerable penalty—the owners engaging to pay a premium of the same amount if the vessel exceeded that speed —Mr. Wilkie, engineer, Glasgow, being appointed umpire. With the above cargo the vessel accomplished the distance between the Cloch and Cumbrae Lights in 52 minutes 11 seconds, being over 18 miles an hour; consequently the builders have won the premium. The "Will o' the Wisp" was designed, built, and engined by W. Simons and Co., London Works, Renfrew.

The Admiralty has at last awakened to the importance of providing, at least a few very fast steam frigates calculated to cope with such vessels as the "Alabama." Mr. Reid, Chief Constructor of the Navy, delivered a lecture on "Ships of War," on Tuesday evening, in the hall of the Literary Institute, Greenwich, in the course of which he stated, with the utmost confidence, that the Admiralty was now building a corvette from which the swiftest iron vessel now afloat could not hope to escape, and which would be armed in a most effective manner. It will be remembered that the Mechanics' Magazine has persistently enforced the necessity of constructing high-speed frigates to defend our mercantile marine.

A new method of case-hardening iron has been patented in Germany by M. Martignoni. The process consists in rubbing the surface of the iron, while at a red heat, with the following composition:—5 parts of cow-hoof, reduced to fine shavings; 5 parts of quinquina; 2·5 parts of common sea-salt; 1·5 parts of saltpetre; and 10 parts of coarse black soap. This mixture is formed into a paste, and applied by a roller, on which it is smeared. The iron is subsequently tempered in cold water.

The Queen has added another jewel to her crown, by prohibiting smoking in the palace at Windsor.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 918, 923, 926, 946.
SHIPS AND BOATS, including their fittings, 914, 955.
STEAM ENGINES, &c.—*none.*
WARFARE, 49.

899. R. K. PENSON. *Improvements in apparatus used for warming railway carriages.* (A communication.) Dated April 9, 1863.

For the purposes of this invention warmers are placed between the seats of the carriages, and in a position to come under the feet of the passengers. It is preferred that each warmer should consist of a flat tubular chamber, but the section and form of the warmer may be varied. A portion of the funnel, or the chimney of the locomotive engine, is partitioned off so as to produce a compartment at the bottom to intercept part of the steam from the steam cylinders. This compartment has a door or cover at the upper part, which, when open, allows the steam to rise up through the funnel or chimney, and escape, as is usual; but when the door or cover is closed, a portion of the steam is intercepted, and a steam pipe connected to the compartment in the chimney or funnel leads the intercepted portion of the steam to the warming apparatus in the passenger carriages. The warmers contained in the different bodies or compartments of a passenger carriage are connected together by suitable steam pipes, and steam having been conducted into the warming apparatus in that one of the passenger carriages of a train which is next the locomotive engine, circulates through the warming apparatus of that carriage, and then by means of suitable couplings or connections between the carriages the steam is conducted from carriage to carriage, and thence ultimately to the open air. It is preferred to form the couplings or connections in the following manner:—At each end of the warmers of each passenger carriage is a flexible pipe, having a coiled wire to strengthen it, and to maintain its figure. This tube and one end of the coiled wire are fixed to a disc or plate, which has a short length of metal pipe with a flange fixed thereto, and the pipe and plate are supported in position by a wire of other metallic stays. When two carriages are coupled, the two ends of two coupling tubes are brought together, and two pendent or lever clips draw and hold the two ends together, so as to form a continuous passage for the steam to pass from one carriage to the next. *Patent completed.*

900. J. R. BURTON, K.H.A. *A new method of and apparatus for cleansing ships' bottoms.* Dated April 9, 1863.

This invention consists of a semicircular tube, varying from 3 ft. to 6 ft. in length, to be proportioned to the size of the ship, and 2½ ft. to 3½ ft. in width, according to the length of the tube. The depth of this semicircular tube is to be 2 ft. and flat at the top to receive the brush, which should be made of whalebone, and fixed to a wooden frame, and which wooden frame will be fastened on the tube by iron straps with eyes at each end to receive a screw to fasten such straps. By this plan a fresh brush can at any time replace the old one when worn out. When the ships' bottoms are very foul, and require more than a brush to remove the weeds or shells, an iron plate can be screwed on at each end of the machine to act as a scraper to tear all obstructions away. *Patent abandoned.*

901. G. FERRAND. *Certain improvements in apparatus for supplying oil or other liquid lubricant to frictional surfaces.* Dated April 9, 1863.

This invention consists in the employment of a bent or angled tube inside the can, one end being attached to and forming part of the delivery tube or spout, the other end being brought near to the interior surface of the "can," the distance being just sufficient to allow the oil to pass into the aperture of the tube, such aperture being at a point about opposite the point of delivery, so that the liquid only covers the aperture, and allows it to pass down the tube, and to the spout, when the can is partly inverted, as in oiling. The delivery spout is held downwards when a flow of liquid is required, from which it issues in drops, air passing up the spout between the delivery of each drop; or air may be conveyed by a separate tube into the "can." A receiver or channel is arranged near the end of the point of delivery to receive and convey waste drops back again to the can either down the spout or down the air tube. *Patent abandoned.*

902. A. V. NEWTON. *An improved construction of offensive weapon.* (A communication.) Dated April 9, 1863.

This invention consists in the combination with a lance of a revolving many-chambered cylinder (of similar character to that commonly used in revolver firearms) arranged to rotate upon the pole or shaft of a lance by having the said pole or shaft passed directly through it. The many-chambered cylinder is made removeable from the lance, and it is furnished at its rear end with a circular series of ratchet-like teeth corresponding in number with the chambers. The lance, pole, or stock is fitted with a hammer so formed and arranged that, by turning the cylinder upon the axis, the ratchet teeth will force back the hammer in such manner as to permit of its being driven forward again by a suitably applied spring. The hammer when driven forward will strike upon the uppermost of a series of percussion caps, or their equivalent, applied in rear of the several chambers and fire the charge contained therein, the charges of all the chambers being in like manner discharged in regular succession. Fitted to the butt of the pole or shaft is a spike, which can be sheathed by being pushed into the pole or shaft when the weapon is to be carried or u d, and protruded from the butt to enable it to be drive into the ground to hold the weapon in an upright position ready to be quickly laid hold of when required for use. *Patent completed.*

903. G. LOW. *Improved machinery for boring rocks and other hard substances.* Dated April 9, 1863.

This invention relates to a novel construction of boring machinery, whereby the driving of adits and the working of quarries may be greatly expedited. The machinery, which admits of various modifications, may be described as consisting of a frame, in which is mounted one or a series of cylinders, fitted each with a piston attached to a hollow rod, which carries at one end a hollow boring tool. The frame will run on wheels for driving horizontal adits or railway tunnels, and against the face of quarries; or it may be arranged to hang from a chain when driving or sinking perpendicular or inclined shafts. Another form of frame (being a portable one) consists of a pillar or column which can be adjusted betwixt the top and bottom of the adit in any position by the attendant. For one arrangement the working cylinders are set on guide frames, along which they slide by a self-acting worm and screw motion, according to the progress of the boring tool. Each of the cylinder frames is so arranged as to admit of being easily moved by the attendant, either perpendicularly or sideways, and also at any angle in either direction, for the purpose of bringing each of the tools into a position suitable for the nature of the rock strata to be bored. The pistons are worked either by steam conveyed by pipes covered with felt, or by compressed air, or by any other motive gases. *Patent completed.*

904. A. V. NEWTON. *An improvement in stirrups, and in the mode of attaching the same to saddles.* Dated April 9, 1863.

The object of this invention is to cause the point of attachment of the stirrup leather to coincide with the points of fixation of the knees. There is gained thereby—1, fixity of the knee, by this union of the point of suspension of the stirrup and of the point of fixation of the knee, whereby the adherence of the knee (the internal condylus of the femur) to the saddle may be permanent, the knee being continually pressed towards the same point; 2, mobility of the leg on the knee-joint, without inconvenience to the upper parts of the body, as the stirrup leather being of the length of the leg, the stirrup and the foot will have the same centre and the same radius; 3, easy pressure of the knee at a given moment—as the foot does not quit the stirrup, all the movements which would tend to move the foot of the rider from the body of the horse will also remove the stirrup therefrom, but by reason of the centre of action of the foot and the stirrup coinciding, the knees will grip the saddle without any attention on the part of the rider, as this connection will exist whatever may be the movement of the foot; 4, bearing upon the stirrup becomes possible, for the stirrup may be borne upon without the knee being moved and the weight of the body being thrown out of its position; 5, more steady equilibrium, by reason of the pressure upon the stirrup, which will bring the weight of the body to the lowest possible point. *Patent completed.*

905. G. COLOMB. *A process of manufacturing factitious blocks of wood of diversified shades and hues proper for veneering and other purposes.* Dated April 10, 1863.

The patentee claims—1, making blocks of factitious wood with joiners' shavings, by rolling up or heaping together shavings of natural or dyed wood, so as to form bundles or trusses of diversified shades or colours, and mixing, if desired, strips of soft metals or other substances with the said shavings; 2, heaping up together several bundles in a frame, packing them tight together; 3, dipping the same into a bath of hot glue, or any other similar agglutinative substance; 4, pressing the blocks thus obtained sideways by suitable presses when dry enough; 5, drying the blocks in a hot room, through which runs a current of hot air—all as described. *Patent completed.*

906. S. A. COUPERIE. *A semicircular metallic slide, whereby the pole bolt is effectually suppressed, and which can be adapted to every four-wheeled vehicle.* Dated April 10, 1863.

This invention is not described apart from the drawings. *Patent completed.*

907. T. BALDWIN. *Improvements in superheating steam, and in apparatus connected therewith.* Dated April 10, 1863.

In carrying out this invention, for the purpose of superheating the steam before it enters the working cylinders of steam engines, the patentee passes the steam from the boiler through any convenient number of tubes placed in a horizontal, vertical, or inclined position. The said tubes are encased in a flue or chamber, through which the hot gases from a separate furnace to that used for generating the steam in the boiler pass, and are diverted in their passage among the said tubes by plates of metal or fire-clay, so as to cause the heat to be more equally diffused in the said flue or chamber. Or he uses the flue or chamber without the plates of metal or fire-clay when necessary. The hot gases from the separate furnace, after passing among the tubes, are conveyed direct to the chimney by a separate flue; or they may be conveyed into the flue of the boiler as required. He places a damper in such a position as to regulate or prevent the flow of the hot gases from the separate furnace among the tubes, and he places another damper to allow the hot gases to pass to the chimney either along the flue of the boiler, or through a separate flue to the chimney, as may be required. The steam from the boiler on its way to the working cylinder passes through the tubes, and becomes superheated by the action of the hot gases from the separate furnace, thereby requiring less fuel to produce a given mechanical effect than when used without being superheated. He also uses tubes placed one inside the other, the steam passing through the space between the tubes, and the hot gases through the lesser tubes and around the larger ones. He places the tubes in the flue or chamber before named. *Patent completed.*

908. S. SHELMERDINE and J. DRANSFIELD. *Improvements in the ornamentation by printing of felt hats.* Dated April 10, 1863.

In carrying out this invention, the patentees make the felt hat body in the shape of a cone, and then print or stain any desired pattern or ornament on the said cone-shaped body by the block or machine printing operation, printing first one side of the cone and then the other, thus giving the necessary ornamentation, instead of making the hat in sections, or of different portions of fancy materials. They then block the body of the required shape or configuration in the usual way. In order to facilitate the operation of printing the said cone-shaped felt hat, they pass it between two or more revolving rollers to give it two flat surfaces; they then place it in a press, or put it under pressure to give the flat surface a greater amount of solidity. If a press be used, it may be worked either by hand or power, according to the amount of pressure required. They print the said hats either in the self-colour, or stain or dye them previous to printing, as may be found most suitable for ornamentation. *Patent completed.*

909. H. R. SPICER. *Improvements in boxes or cases for the enclosure and preservation of human remains.* Dated April 10, 1863.

This invention consists in the use of glass for the manufacture of boxes or cases of any desired configuration for the enclosure and preservation of human remains. These glass boxes can be hermetically sealed. In some instances, for the further securing or aiding the preservation of the contents, the inventor produces a vacuum or partial vacuum within the said glass boxes by exhaustion. The said glass boxes or cases may be enclosed in an outer case or shell of wood of the ordinary kind. *Patent abandoned.*

910. R. SMITH. *An improved medicated oil for the preservation of metal, wood, or stone.* Dated April 10, 1863.

This invention consists of an improved compound, to be used either alone or in combination with any description of paint, for the preservation of iron or wooden ships, buildings, or articles made of metal, wood, or stone, and is also applicable for the renovating of oil paintings and paint work, and is composed of the following ingredients:—The patentee takes, say, one gallon of any description of oil, and a like quantity of water, to which he adds about 2 lbs. of saltpetre, salt, or soda, either mixed or separate. If the compound is intended for the preservation of stone, he adds about 2 lbs. of soluble sulphur. *Patent completed.*

911. J. WIGHTMAN and C. DENING. *Improvements in horse rakes.* Dated April 10, 1863.

This invention consists in making the tines of such rakes of tubular or hollow form, whereby the rake is rendered much lighter in draught; it is also easier to lift when working. *Patent abandoned.*

912. J. GIMSON. *Improvements in screw-cutting lathes.* Dated April 10, 1863.

This invention consists in so constructing, fitting, and applying parts to such lathes that a tool or tools is or are applied to the operation of cutting the thread or threads of screws while the screw under operation is being rotated in either direction; that is to say, the screw will be cut by a tool or tools actuated and advancing in the ordinary manner, as also (while such ordinary tool is being run backwards, and the screw under operation is rotated in the opposite direction) by another tool or tools thrown in during the time the first-named tool or tools is or are out of action; thus the operation of cutting the screw may be said to be a continuous operation; and the time in running back the saddle is not lost, as in the ordinary manner. *Patent abandoned.*

913. H. W. RIPLEY. *Improvements in machinery for preparing and printing wool and other fibres.* (A communication.) Dated April 10, 1863.

This invention consists in combining a gill box or gill mechanism with printing machinery, in order that an even sliver or web may be produced, and then printed by the combined machinery. It has before been proposed to print slivers and webs of wool or other fibre with parallel transverse lines or devices, and then, after printing, to subject the printed fabrics to a process of drawing before spinning, as to cause the printed fibres to slide amongst themselves, and thus to extend or shade off the printed lines or devices. The present invention consists in combining the gill machinery used in preparing or producing an even web or sliver of wool or other fibres with a printing machine, so that the sheet or web of fibres may at once pass from the preparing gill machinery ink, and be acted on by the roller printing machine, without requiring to be made into rolls, or be handled and conveyed between one machine and the other. *Patent completed.*

914. H. CAUDWELL. *Improvements in the construction of vessels of war, part of which improvements is applicable to fortifications.* Dated April 10, 1863.

This invention is not described apart from the drawings. *Patent completed.*

915. F. VERSMANN. *Improvements in moulding machines.* Dated April 11, 1863.

The patentee claims—1, the method by which a certain quantity of the material introduced into the machine is delivered in any form or shape required by a screw revolving in the interior of a hollow cylinder, with an intermittent action, or any other arrangement producing the same effect, such as a plunger or piston, or a reciprocating blade or cylinder, with a semi-rotary piston, as described; 2, the peculiar method of cutting off the said material into given lengths by means of the reciprocating cutters or knives mounted in a frame; 3, the intermittent action, and the mode described of obtaining the same, and communicating it to the endless bands for assisting the delivery of the material, and alternately to the feeding screw or other feeding power, and the cutting-off frame. He does not confine himself to the method described, but he claims all such other methods as may accomplish the same result. *Patent abandoned.*

916. J. LOCKWOOD. *Improvements in steam boiler and other furnaces.* Dated April 11, 1863.

This invention consists in having the bridge formed hollow with a grating towards the fire bed, and open to the ashpit, and a swing door placed behind the grating, capable of being operated by a rod from the front of the furnace, by which it may be closed against the openings of the grating, or removed therefrom, as required, to admit atmospheric air, whereby smoke will be consumed. *Patent completed.*

917. D. MYERS. *Improvements in fire bars or furnace grids.* Dated April 11, 1863.

In carrying out this invention, the patentee makes the cross bars of a waved, zig-zag, or corrugated shape, either circular or angular, with a groove on the upper surface to catch or collect small dust from the ashes from the fuel, which dust being a non-conductor of heat, preserves the bars from being soon consumed or burnt, and also prevents the coals from clinkering. In one arrangement he casts the side bars and cross bars together, so as to form a framework or grid for the furnace, and makes the side bars either straight or corrugated; but in either case there is a groove or recess on the surface of the side and cross bars for the collection of the dust or ashes. This plan enables him to make the bars much lighter than the usual form, as well as economizing fuel and metal, and preventing the clinkering of the coals. The corrugated or zig-zag surface of the bars, by presenting the greatest amount of surface to the action of the atmosphere, keeps them cool. *Patent completed.*

918. W. SAMUEL. *Improvements in, or applicable to, railway carriages, to mitigate or lessen the effects of collision to passengers.* Dated April 11, 1863.

This invention consists—1, in constructing carriages with a larger number of transverse partitions therein than there are in those at present in use, and between such partitions placing across the carriages one row of seats only, so that passengers shall not set opposite to each other, and there shall not be danger from one person being thrown against another at the instant of collision; 2, in placing round railway carriages, of whatever construction, at or about the height of a man's shoulder when he is sitting on the seats of such carriages, and for a short distance both above and below such height, air cushions, made of india rubber, or other flexible material, assisted by metal or other springs, or by padding or stuffing of any kind. *Patent abandoned.*

919. J. FARRAR. *Improvements in machinery or apparatus for twisting or doubling yarns of wool or other fibrous substances.* Dated April 11, 1863.

This invention relates to machinery having rotary spindles, and the improvements consist—1, in having bushes to the spindle rails or copping rails, which project upward sufficient to pass through the bobbins which are placed thereon. The spindles pass through these bushes, and are thereby held steady. 2, The improvements consist in having a ring fixed on the arms of each flyer, to prevent expansion thereof when run at high speeds. The "tweezles" may be fixed in this ring, or be formed on the arms as at present. *Patent abandoned.*

920. W. CLARK. *Improvements in separating ores from their gangues, and in apparatus for the same.* (A communication.) Dated April 11, 1863.

The patentee claims—1, the improved apparatus for classifying ores, consisting of a series of screens or sieves of different degrees of coarseness, serving to collect the particles of the ore in uniform sizes of grain, as described. 2, the several modifications of the above-mentioned apparatus as represented in the drawings; 3, the improved atmospheric separating apparatus in which a forced current of air is employed for acting on ores of different gravity, although of same size, in order to separate the quartz from the metal particles as described; 4, the improved apparatus for treating schlammes, the sieves having a to-and-fro motion imparted in the manner described; 5, the arrangement of cup chain for supplying the ore in a continuous manner into the hoppers of the several apparatus, all as applied, described, and represented in the drawings. *Patent completed.*

921. P. P. BALY. *Improvements in constructing breakwaters, piers, sea walls, and other similar structures.* Dated April 11, 1863.

In constructing breakwaters, piers, and other similar structures having two parallel or nearly parallel faces, or faces inclined to one another, the patentee employs at intervals transverse frames constructed of cast or wrought iron bars, or rods, or plates. These frames are, by preference, triangular in form, and are, if necessary, strengthened interiorly by other bars, or rods, or plates dividing the frame up into a number of small triangles. The base of the frames is suitably secured to the bottom, or is supported thereon, upon screw or other piles or chairs of iron, wood, or stone, upon a bank of stone, or other made foundation; or the frames and plating attached to them may be supported by the plating resting upon the ground, or upon a made foundation. To the sides of the frames cast or wrought iron frames are fixed to form the two parallel or nearly parallel fac s, or faces inclined to one another, of the structure. These plates are corrugated or arranged in ridge and furrow; the corrugations or ridges run horizontally in, and they serve to give great rigidity to, the structure in this direction. These corrugated plates, or plates arranged in ridge or furrow, may be of wrought or cast iron, and connected togther and to the frames by bolts and nuts, screws, rivets, clips, or in any other suitable manner. In joining the plates together endways, it is preferred to make those of one row break joint with those of the next row. In a direction at right angles to the corrugations or ridges, a certain amount of stiffness is given by the transverse frames before mentioned, and these are assisted by means of bars placed on the exterior of the plating at distances apart equal to the distances between the transverse frames. These bars are placed opposite and parallel to the sides of the frames, and are securely fixed to the top of each corrugation or ridge of the plating, which they cross, as are also the exterior bars of the transverse frames above described. Thus it will be seen that the sides of the transverse frame acting with the corrugated or ridged plating attached to it, and with the exterior bar parallel thereto, form together a framed girder of great strength. In order to give additional stiffness to the corrugated or ridged plates, pairs of bars or single bars may be made to cross, and be fixed to the corrugations or ridges upon the exterior and interior of the plating, and intermediate between the frames above described. *Patent completed.*

922. A. F. MACLURE. *Improvements in looms for weaving figured fabrics.* Dated April 11, 1863.

This invention relates to the arrangement and construction of certain parts of mechanical details of looms, so as to obtain by means of a positive movement a great variety of patterns in the fabrics produced. Under one modification or system of arrangement for actuating the heddles in the required sequential order, two levers are centred upon a stud carried in the loom framing. These levers extend towards the front of the loom, and are slotted at the central parts so as to admit of the driving shaft passing through them, and of their reciprocatory movement in a vertical direction. These levers are actuated by two cams on the driving shaft, which act on pulleys fitted to the levers, and cause them to rise and fall alternately. The front ends of the levers are connected by vertical links to two knife-edged lifting bars which are arranged beneath. These levers traverse up and down in guides which are formed in a pair of standards fixed to the floor, and extending parallel with the loom framing. On the wiper shaft of the loom is fitted a cam which gives a slight vertical movement to a rod, T-shaped at its upper extremity, and carrying therein a series of pins which extend through the T-piece on both sides. The movement of this rod up and down brings the row of pins alternately opposite two rows of holes formed in a small rotary barrel, similar to the barrel of a jacquard machine. This barrel moves in unison with the shedding action of the loom, and carries with it an endless chain of cards, perforated to produce the required pattern. Each pin in the T-shaped rod is opposite one of the long vertical rods, which are connected to the heddle levers. These rods are kept in one direction by means of helical springs, so long as the pins in the T-shaped rod enter the holes formed in the endless chain of cards; but when the solid card intervenes, the opposite end of the T-shaped rod pushes the contiguous rod back and this brings one of the hooks which are formed on the rod under the edge of one or other of the lifters. In this way, by the proper arrangement of the cards, the heddles may be actuated in any required sequence, so as to produce a great variety of weaving effects. In connection with these mechanical arrangements is one for causing the shuttles to be operated in any desired order, for the purpose of varying the colours of the figures or other ornamental effect. *Patent completed.*

923. C. A. COLLINS. *An improved method and apparatus for loading carts and waggons with hay, straw, and other similar products.* Dated April 11, 1863.

This invention consists in an apparatus or machine on wheels which is attached to the back of a cart, and is set in motion by being drawn after the cart. Such machine includes a combination of two endless bands; each of such endless bands work on pairs of horizontal rollers or wheels connected by an axis, the hindermost band being carried in a direction opposite to that of the cart wheels, while the foremost band works in the same direction as that of the cart wheels. Each band is carried within a short distance of the ground, the hindermost band being the nearer to the ground, and as the incline is drawn after the cart, such hindermost band being caused to move in a direction contrary to that of the cart, collects the hay upon the ground over which such bands passes, and brings the hay into contact with the foremost band, and the hay is thereupon elevated and carried on to the cart. *Patent completed.*

924. J. RAMSBOTTOM. *Improvements in machinery for hammering, rolling, and shaping metals.* Dated April 13, 1863.

This invention consists—1, in certain improvements in or applicable to duplex or compound steam hammers, having two or more hammer blocks moving in opposite directions towards the metal to be operated upon, in such wise that the acting forces may counteract each other, and so avoid in most cases the use of an anvil. 2, in an improved combination of machinery for rolling and shaping metals. The invention cannot be described without reference to the drawings. *Patent completed.*

925. J. GILL. *Improvements in printing machinery.* Dated April 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

926. A. ROLFE. *Improvements in means or apparatus for propelling carriages on railways, tramways, or on common roads.* Dated April 13, 1863.

In carrying out this invention, the inventor arranges on a carriage, suitably constructed for the purpose, a wheel or wheels of proper size, which is or are mounted on frictionless bearings, and actuated (by preference) by men working the handles or cranks attached to the said wheel or wheels, though steam or air engines or other means may be employed for this purpose. These fly-wheels are connected by means of endless bands or straps with a series of one or more wheels, suitably mounted on the framing carrying the fly wheel or wheels, and are finally connected (by means of fast and loose pulleys on the axle) with the wheels running on the road, and to which the power is thereby imparted. In working the apparatus, when the time arrives for stopping the train or carriages, the strap connected with the driving wheel is shifted on to a loose pulley from the pulley which actuates these wheels, and when there, instead of the men or other power working the levers stopping the fly-wheel, they continue it at work, and the power so obtained is accumulated by the fly-wheel until required when starting the train, when, on the strap being shifted to the fast pulley, the carriage will be at once propelled forwards. When it is required to stop the carriage, brakes are applied in the ordinary manner, or they may be so adapted as to cause the power wasted in the act of "braking" to be transmitted by suitable gearing to the fly wheel or wheels. When required to reverse the carriage, the fly-wheel may be stopped, and the fly-wheels reversed by working them backwards; or the wheels may be continued in the same direction, and the motion may be reversed by having crossed straps working on fast and loose pulleys, so that the pulleys work different ways on the straps, being shifted as is well understood. *Patent abandoned.*

927. R. LEGGETT and R. GITTUS. *Improvements in the construction of machinery or apparatus for cutting chaff and other agricultural produce.* Dated April 13, 1863.

The first part of this invention consists in the adaptation of moveable knives, in place of fixed ones, for the purpose of producing a drawing cut throughout the stroke or passage of the knives. The second part of the invention relates to the construction of the pressure plate, which the patentees term a "duplex" pressure plate, one portion of it moving vertically in the ordinary way, but the other portion having a circular motion corresponding with the circumference of the top feeding roller, to which it closely fits, in order that the space between the vertical portion of the pressure plate and the said roller shall always be completely filled up, so as to prevent any choking of the material to be cut. The third part of the invention relates to the mode of constructing the feed rollers. Instead of these rollers being notched or grooved longitudinally, they have deep ribs cast on them in the direction of their circumferences. The ribs traverse the circumference of the said rollers, not at right angles to their axes, but more or less inclined thereto—the inclination of the ribs of the top roller being one way, and those of the bottom roller the other way. This difference of direction of the ribs on the rollers has the effect of straightening out the separate straws or fibres of the material to be cut, when lying crosswise, sending them through the mouth of the machine at right angles to the plane in which the knives revolve. *Patent completed.*

928. J. LARK. *Improvements in the manufacture of artificial fuel and cement.* Dated April 13, 1863.

In order to produce artificial fuel, the inventor takes lime-stones, chalk, cement-stones, gypsum, slate, or other stone which becomes porous when calcined; or clay may be employed; and having calcined the same, he boils or mixes the material which should then be in lumps of suitable size for fuel, with gas-tar, pitch, bitumen, or bituminous matter. In this manner the lumps are thoroughly saturated with the material, which is kept liquid by sufficient heat. He also sometimes employs a small quantity of paraffin, naphtha, resinous and fatty and oily matters, to increase the inflammability of the fuel. After fuel thus prepared is burnt, the residue when ground makes a good cement suitable to Roman cement. *Patent abandoned.*

929. R. REEVES. *Improvements in the manufacture of liquid manure drills.* Dated April 13, 1863.

According to this invention, in place of employing a number of separate cups or dippers attached to a wheel, the patentee casts the cups or dippers in one piece with the wheel. By this means the cups or dippers cannot possibly get out of their proper position as they now sometimes do, and, in addition, the wheel, together with the cups or dippers, can be made at a less cost than heretofore. *Patent completed.*

930. R. NEWTON. *Improvements in machinery for separating and straightening the fibres of silk waste and other fibrous substances.* Dated April 13, 1863.

This invention consists in mounting in a moveable rotating frame two or more cylinders armed with teeth or combs, which are filled with the fibrous material from the feeding-in apparatus in the usual manner. On the axle of each of the comb cylinders is mounted a toothed wheel, which, when the cylinder is brought into a position to be filled, is put in gear with driving gear attached to the same. Upon the machine being set in motion, and the fibres fed in, the comb cylinder is made to rotate, and gradually fill the combs with fibres. When filled, the cylinder must be removed, and a fresh cylinder put in its place. To effect this, the rotating frame in which the comb cylinders are mounted is drawn back a short distance, and then made to rotate on its axis, so as to bring away the filled cylinder, and put in its place an empty one. The rotating frame is then pushed back, so as to bring the toothed wheel on the axle of the empty cylinder into gear with the driving wheels of the machine. The rotating frame is kept steady by causing a projecting pin thereon to take into a corresponding socket on some convenient part of the stationary framing. *Patent completed.*

931. M. MYERS. *Improvements in the construction of trunks, portmanteaus, and boxes.* Dated April 13, 1863.

In carrying out this invention, the patentee forms the trunk, portmanteau, or box of wicker or basket work, wood, leather, or other light material, and covers the exterior with leather, leather cloth, or other waterproof fabric, the interior being lined in the ordinary manner. He makes the top or lid of the box with a collapsible or bellows-formed receptacle, the entrance to which is through an aperture exposed when the lid is thrown back or opened. He also makes baskets, portmanteaus, or boxes with a plain lid or top, and makes the upper half of the box collapsible. He arranges springs in the interior of the collapsible receptacle in such manner that they shall open or raise them to their utmost limit ready for being packed. When the box is closed, the collapsible receptacle may be compressed by means of the straps. *Patent completed.*

932. T. MALLINSON and P. WILLIAMS. *Improvements in machinery for opening, cleaning, carding, and grinding or sharpening cards used in preparing cotton and other fibrous materials.* Dated April 13, 1863.

The object of this invention applies to machines for opening and cleaning cotton and other fibrous materials, and also to carding engines, and consists in the use in such machines of a fluted feeding roller, having its flutes formed into the shape of ratchet teeth, the inclination of the flutes being in a direction opposite to that of the motion of the "beaters" or the teeth of the cylinder or "openers" or blowers or the lickers-in or cylinder of carding engines, at the time when such beaters or teeth are passing the feeding roller. A roller with pointed teeth, or an ordinary fluted roller, is used in combination with the ratchet fluted feeding roller. The second part of the invention is also applicable both to "openers" or blowers, and to carding engines, and consists in the use of a series of bars, which are curved to correspond to the convex sur-

face or cylinder circumscribed by the beaters or the points of the teeth of the cylinder, or of the licker-in, which takes the fibrous material from the feed rollers. These bars are arranged together with spaces between them to form a grid, and the concave edges of the bars are serrated, and the whole grid is arranged so that a reciprocating motion can be imparted to it in a direction parallel to the axis of the beater, toothed cylinder, or licker-in. The third part of the invention relates to carding engines, and consists in arranging a partition or cover between the ends of the card rollers, clearers, or cylinders, and the "bends" or sides of the engine, to protect the bearings of the card rollers or clearers from "fly" driven out by the current of air produced by the card cylinder; these partitions or covers are adjustable to the axis of the rollers and clearers, as their position is changed in adjusting them to the wear of the cards. The fourth part of the invention relates to the doffing motion of carding engines, and consists in the following arrangement and combination of mechanism:—On the end of the oscillating shaft carrying a peculiarly curved doffer comb, an arm is secured, having a slot in it the lengthway of the arm, in which slot an adjustable stud or pin is secured, which fits so as to slide freely in another slot lengthway in one end of a lever placed immediately in front of the arm; the fulcrum of the lever is upon a stud secured in the framing, and at the other end of the lever another slot is formed in which a crank pin or eccentric works, which is attached to a pulley carried in suitable bearings, which pulley is driven by a band from any convenient part of the engine. By this means the lever has oscillations imparted to it which are transmitted by means of the stud to the arm of the oscillating shaft. The stud is adjustable, so that the length of the oscillations of the comb shaft can be varied when required. *Patent completed.*

933. J. NASMITH and S. THORNTON. *Improvements in machinery for carding cotton and other fibrous substances.* Dated April 14, 1863.

The object of this invention is to strip the fleece of fibres from the doffer of the carding engine; and the nature of the invention consists in certain improved modes of working the stripping comb, so that the teeth of the comb shall clear the doffer at the up stroke. In performing the invention, the inventors make use of a comb of the ordinary construction fixed to arms projecting from a tube, or partial tube, to which two or more straps or bands are attached, parts of which are provided with adjusting screws and nuts, and the others with springs; these straps or bands form the fulcrum, and limit the range of the comb, which is worked by eccentrics or cams on a cross shaft. *Patent abandoned.*

934. G. BERRY. *Improvements in locks.* Dated April 14, 1863.

This invention has reference to that description of lock in which a number of sliding guards pass through notches in a locking plate also having notches in it. The first improvement consists in cutting notches on the sliding guards at right angles to the notches which have to pass the locking plate. The inventor then places an immoveable mask or partition in each of the first-named notches, and these masks or partitions consist of rings placed in a barrel, or a plain plate placed in a box when the motion intended to open the box is lineal instead of circular. The result of this arrangement is that the notches in the guards cannot be got at by any instrument whatever, as they are placed in a line parallel to the part acted upon by the key, but separated by masks or partitions. The second improvement consists in cutting the sliding guards into two parts, in such a manner that, if force be applied to one part, that force will be communicated to the other, and both will move in the same direction. Those parts through which force and motion are communicated to the other parts are called media; and the result is, that no vibration of those parts which indirectly receive force and motion is communicated to the key or any instrument applied to open the lock. *Patent abandoned.*

935. G. T. SMITH. *Improvements in metallic window-shutters.* Dated April 14, 1863.

This invention is not described apart from the drawings. *Patent completed.*

936. W. and J. KEATS. *Improvements in the manufacture of boots, shoes, or other coverings for the feet.* Dated April 14, 1863.

In manufacturing boots, shoes, or other coverings for the feet according to this invention, the edge of the sole has a strip cut from its under side all round its edge, so as to leave all round the upper edge of the sole a strip of less thickness than the rest of the sole; to this thin strip, the edge of the upper, previously cut to the required shape, is sewn, the outer face of the upper being towards the outer face of the sole. The upper and sole are then turned inside out, and the boot or other covering for the feet may then be finished as though the upper had been connected to the sole in the usual way. In addition to the sole being cut as above described, so as to leave a thin strip around its edge, the patentees prefer to enlarge the strip by cutting with a suitable tool a slit into the edge of the sole, just below the bottom or under side of the strip. In constructing boots, shoes, or other coverings for the feet, when a welt is employed, they stitch together all round their edges the insole, the welt, and the upper, the under side of the insole and the outer face of the upper being at that time towards each other, and the welt being between the two. The upper and the insole are then turned inside out, thus causing the welt to project outwards from the insole; the welt may then be connected by stitching or otherwise to a bottom or outer sole formed to the shape of the last, thereby rendering it unnecessary to shape the welt until the said parts are connected. In order to facilitate the parts being turned inside out, they should—except when very thin leather is used—be wetted previous to being turned. *Patent completed.*

937. J. COMBE and J. H. SMALPAGE. *Improvements in the action and arrangement of machines for winding cops, in the construction and arrangement of banks for holding cops for warping purposes, in the formation of shuttles for receiving cops, and for apparatus for packing and securing cops in shuttles; one part of which improvements, consisting of a spring clutch, is applicable to machines in general.* Dated April 14, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

938. J. KEATS and W. S. CLARK. *Improvements in sewing machines.* Dated April 14, 1863.

The patentees claim—1, the combination of apparatus employed; 2, employing a shuttle in a sewing machine, to work in combination with a hook, for the purpose of producing a lock stitch with two threads; 3, placing the shuttle and shuttle race of sewing machines above the table or surface on which the material to be sewed rests; 4, the arrangement of apparatus described for operating a hook, a shuttle, and a feeder from eccentrics in one needle box; 5, the arrangement of apparatus described for dividing the loop of thread that is drawn up by the hook, and for spreading the loop over the shuttle; 6, the arrangement of apparatus described for supplying the thread to the hook; 7, the arrangement of apparatus described for shortening or lengthening the stitch, and for feeding the work at any angle. *Patent completed.*

939. H. TRAPNELL. *Improvements in vent pegs.* Dated April 14, 1863.

This invention consists in making such vent pegs in the form of a metal tube, provided with an ordinary cock, and having a screw thread formed on the lower end, so as to enable the vent peg to be screwed into the barrel or receptacle in place of being driven therein in the ordinary manner. By turning the plug of the cock, the entrance of the air can be regulated, and more readily shut off, than with the ordinary vent peg. The top of the vent peg or tube may be closed, if intended to be driven into the cask by a mallet or hammer, and is slightly expanded and provided with lateral apertures for the entrance of the air or the escape of gases from the cask or receptacle, according to the purpose to which it is applied. *Patent abandoned.*

940. R. A. BROOMAN. *Improvements in hardening and colouring gypseous limestone and sand and calcareous stones.* (A communication.) Dated April 14, 1863.

In hardening gypseous lime-stone, the inventor first reduces the pieces of stone to artistic dimensions, such as balustrades, friezes, columns, &c. He then dries them in a stove heated to a certain temperature. After removal from the stove the pieces of stone are placed in a bath containing a mineral solution. The bath may be composed of lime water, sulphate of iron, cyanides, alumina, potass, soda, or vegetable substances perfectly combined with minerals, or substances obtained from alkaline matters. For colouring, recourse is had to a chemical operation, whereby the inventor obtains a transformation of colours, by making one solution to chemically succeed another. *Patent completed.*

941. R. A. BROOMAN. *Improvements in apparatus for burning light and heavy mineral and vegetable oils.* (A communication.) Dated April 14, 1863.

In lamps with a side supply cistern, the inventor uses a wick carrier tube, and surrounds it by a concentric tube, space being left between the two for holding the wick, and a supply to the same; a plate or ring, with an air passage through the centre, closes the bottom of both tubes. He prefers to use a button to spread the flame; this button is carried on a rod worked by a pinion or projecting spindle, while another spindle is fitted for raising and lowering the wick; a deflecting cone, the edges of which are turned up to hold the chimney, or chimney and globe, slides up and down the outer tube; the top of the cone should be set on a level with the top of the burner. An inclined tube forms a communication between the annular chamber formed between the wick holder tube and that which surrounds it and the bottom of the supply cistern. The level of the supply in the cistern should be in a line with the top of the burner, or a little below it, according to the density of the oil, and the bottom thereof should be on a level with the inclined conducting tube. To maintain the level in the supply cistern, it is formed with a inner box or case which holds the oil, which flows out through a thimble on the pottom thereof, closed by a moveable valve; this valve opens as soon as the box is placed in the outer case. As the level lowers, so the oil flows out from the inner box. The thimble is hollowed in front to the exact height to which the oil is to rise to the burner, so that when the oil becomes consumed at the burner, the air entering the inner box allows a sufficient quantity of oil to run out and rise to the level of the burner. He places a bridge above the entrance into the inclined conducting pipe to prevent the oil bubbling up at the burner. *Patent completed.*

942. J. SMITH. *Improvements in furnaces and boilers for the generation of steam, partly applicable also for other purposes.* Dated April 14, 1863.

In constructing a furnace according to this invention, the patentee makes each alternate fire bar moveable, and forms these inner bars at their inner or back ends with a curved notch, which rests upon a fixed bearing bar, and their outer ends with rack teeth situated in an angular direction, and resting upon and taking into corresponding teeth or segments formed with or fixed upon a bearing bar capable of partial revolution. This bearing bar may either be moved or turned at intervals by hand, or otherwise by means of steam or other power; and when turned or moved as required, will, by means of the toothed segments or pinions referred to, draw forward the racks or bars, and by so doing will (owing to the inclined position of the racks) cause the front ends of the bars to mount or be raised, while at the same time the curved notches at the back, by passing over the fixed bearing bar, will, in like manner, raise the inner or back ends of the bars, thus breaking up any clinker that may be formed upon or between the bars. Bars formed as described are applicable to furnaces for various purposes. The second part of the invention is applicable to locomotive and other similar types of boiler, and consists in dividing the furnace or fire box part thereof horizontally into two portions by means of a water space, situate above the fire grate, a little below the level of the lowest row of tubes, passing through the body of the boiler. The third part of the invention is an improvement in the fusible plug made use of to prevent danger or injury to boilers by deficiency of water. It consists in forming the body of the plug (which has usually been made in one piece screwed direct into the crown of the boiler furnace) in two parts, so that the one part containing the plug may at any time be removed without disturbing the part which is screwed into the boiler. Lastly, he forms that part of the plug which is intended to be blown out by the fusion of the soft holding metal, and the hole in which it is placed, in such manner as to present a greatly increased resistance to the blowing out of the plug by pressure alone. He effects this either by cutting grooves or screw threads in the hole, and similar grooves or threads in or upon the blow-out piece, and running the fusible metal between, so that the whole depth of the fusible metal must be sheared for pressure alone to have the effect referred to. *Patent completed.*

943. J. LEACH. *An improved machine or apparatus for washing, squeezing, mangling, and churning.* Dated April 15, 1863.

In carrying out this invention, the patentee makes use of a barrel or other suitably formed vessel for containing the water and clothes or other articles to be operated upon. This vessel is formed or fitted with trunnions working in suitable bearings (carried by the framing of the machine), so as to be capable of being revolved end over end, and is closed by means of a cover held down by pressure screws which force it against an india-rubber or other partially yeilding packing, so as as to produce a water-tight joint. The pressure screws whereby the cover is held down pass through a frame, which is entirely removeable from the barrel or vessel, leaving no projections above its top, thus affording every facility for the introduction and removal of the clothes or other articles treated. To the interior surface of the barrel or other vessel, at suitable intervals apart, are fixed circular or other conveniently shaped rubbers formed with grooves to give increased surface for acting upon and turning the clothes or other articles to be treated. The inner side of the cover and of the bottom of the vessel are likewise provided with projecting, grooved, or corrugated surfaces or discs, and a grooved or corrugated tilting-board is attached to the interior of the vessel, extending partly across it, at or about the centre of its vertical length. In addition to the foregoing—which consitute the fixed arrangements of the interior of the barrel or vessel—he makes use also within the vessel of a loose or moveable piece formed, by preference, in the shape of an oblate spheroid (but which may be of any other convenient form), the specific gravity of which is such as will cause it to sink in the water or other washing liquid employed, and which is provided with corrugations or projections, so that, by the revolution of the barrel or vessel, it becomes to some extent entangled with the clothes or other articles contained therein, carrying them against and between the rubbers until, being caught by the tilting-board, it, with the clothes or other articles, is carried upwards until, in the course of the revolution, it falls from the tilting-board, and is again caught and carried up as before. In this way the clothes with the moveable piece (which is termed a "dolly") are at each revolution precipitated through the liquid to the bottom of the vessel, thus causing a thorough washing and sluicing, whereby the clothes or other articles are effectually cleansed. The squeezing and mangling are effected by rollers suitably arranged. *Patent completed.*

944. E. P. COLQUHOUN and J. P. FERRIS. *Improvements in fire bars for the furnaces of steam boilers and fire grates.* Dated April 15, 1863.

These fire bars are supported near their centre on two bearing bars partially revolving on their axes. The fire bars on their upper surface are considerably curved to give strength at the point mostly required. On the under side there is cast on the bars, a pin or tougue, fitting into holes formed on the bearing bars, which serve to keep the fire bars in position, and form the draught or air spaces. One half the required number of fire bars necessary to form one tier or range in a furnace are carried by one bearing bar and the remaining half by the other placed in juxtaposition. The fire bars are so packed in the bearing bars that a space sufficient for a fire bar is left between each, so that when the two bearing bars with their allotted number of fire bars are arranged in their proper position, the fire bars carried by each bearing bar dove-tail into each other, and form the furnace, with the necessary width of air space between each fire bar. Cast on the side of each bearing bar are teeth, so that when one bearing bar supporting one half of one range of bars is moved, the bearing bar in juxtaposition, and supporting the other half of the same range of bars, moves in an opposite direction, causing an extensive lift or upward motion to be given to all the fire bars; but while the ends of one half of the number of the fire bars are being raised, the ends of the other half are descending by the side of the uplifted section. *Patent abandoned.*

945. T. GRAY. *Improvements in preparing and bleaching flax, hemp, and other vegetable fibres, by which a brilliant lustre is imparted to those substances, and the fibres are separated.* Dated April 15, 1863.

This invention consists in a method or process of treatment whereby the fibres are so prepared and bleached, that they acquire a brilliant lustre, besides becoming separated and thus fitted for spinning and for other purposes. The flax, hemp, or other vegetable fibre is laid or boiled in soda-ash liquor, or other alkali, for three or four hours; the material is then rinsed and dipped in sulphuric acid water, and, after being slightly drained, is placed in bleaching liquor for about an hour, then rinsed and drained; and afterwards dipped or placed in weak acid water for a few minutes; it is then taken out and slightly drained, so as to leave it still impregnated with the acid; it is then dipped or laid in soap-suds, made from soap in which fat and oil form the chief ingredients. After being rinsed in cold water it is hung up till dry, and is then fit for use. *Patent completed.*

946. W. CLARK. *Improvements in apparatus for the transport of goods.* (A communication.) Dated April 15, 1863.

This apparatus consists of a carriage or platform, which may be constructed of iron, and is furnished at the upper part with small rollers running on rails, which extend in all directions throughout the storehouses, and wherever the merchandize is to be conveyed to, especially along quays. These rails are made portable, and possess the advantage of only occupying the way for a few minutes until the loading is completed, when they are at once removed without trouble or expense. These rails consist of a kind of ladder, the cross bars of which are furnished with iron hooks to prevent the sides from opening, and so keep the rails at an invariable width apart. *Patent abandoned.*

947. H. A. BONNEVILLE. *Improvements in the construction of gas burners.* (A communication.) Dated April 15, 1863.

The patentee claims the construction of gas burners by means of which the combustion of the gas operates without pressure by the holes of a reservoir placed above the tube which regulates the supply. *Patent completed.*

948. A. MARRIOTT. *Improvements in boilers for heating buildings, and in regulators for the same.* Dated April 15, 1863.

In carrying out this invention, the patentee constructs the boiler with an annular water space at the top and bottom, these two water spaces being connected together by vertical tubes. The flow pipe is connected to the upper annular water space, and the return pipe to the lower annular water space. The grate is placed in the interior of the lower annular water space, and is mounted on pivots capable of being tilted by means of a lever outside, so as to empty the contents into the ash-pan. Above the upper annular water space is an annular smoke-box, one side of which is connected to the chimney or flue, and the opposite side to the central fire space, so that the heat and smoke are compelled to pass round the upper annular water space, instead of passing directly to the chimney or flue. The ash-pan is enclosed, air being admitted or shut off by means of a damper, which is opened or closed by a regulator constructed as follows:—In connection with the flow pipe, close to its junction with the upper annular water space, is placed a bulb or hollow sphere of cast iron or other metal, and inside this hollow sphere is placed another hollow sphere of smaller diameter, so that as the hot water passes along the pipe, it circulates freely round the inner sphere, and communicates its heat thereto. The lower side of the inner sphere is connected by a metallic pipe to an elastic tube, closed at the bottom, and attached to the damper by a screwed rod and swivel. The upper part of the inner sphere is also furnished with a pipe, which passes upwards through the outer sphere, where it is closed by a screw cap. Mercury is poured into the inner tube through the last-mentioned pipe, filling the sphere and elastic tube, and the cap is replaced. It will now be evident that, as the temperature of the water increases, it will cause the mercury to expand, and lengthen the elastic tube, and thus cause the rod to close the damper; and as the water cools, the mercury contracts, and allows the elastic tube to open the damper and admit air to the fire. *Patent completed.*

949. W. SPENCE. *Improvements in the manufacture of gunpowder.* (A communication.) Dated April 15, 1863.

The first kind of powder made according to this invention, and which is suitable for ordnance, is composed of the following ingredients, in or about the following proportions, and the process is as follows:—The patentee puts into a cooking or other similar vessel 38 parts in weight of water, and two parts in weight of finely pulverized charcoal, which are to be thoroughly boiled together; he then adds 20 parts in weight of chlorate of potash, and 6 parts in weight of a mixture (hereinafter referred to as mixture A), and stirs it until the whole is thoroughly mixed. By this addition the boiling will be interrupted, and, therefore, the whole mixture must be brought again into a boiling state. After this there is added 7 parts in weight of fine well sifted and thoroughly dried sawdust or pulverized bark, and the boiling is continued until the wood is thoroughly saturated, and becomes part of the mixture. The mixture A above referred to consists of 2 parts in weight of finely pulverized coal, and from 3 to 4 parts of bicarbonate of soda, or nitrate of lead or saltpetre, or their chemical equivalents. The requisite evaporation or drying of the mixture may be effected by means of open pans to which steam is applied, and the granulating process is the same as usual. *Patent completed.*

950. H. EATON. *Improvements appicable to presses for baling purposes.* Dated April 15, 1863.

We cannot here give space for the details of this invention. *Patent completed.*

951. J. S. MORTON. *Improvements in locks.* Dated April 15, 1863.

In these locks the key does not act directly upon the bolt, but upon a plate which the key causes to revolve. This plate is fitted inside the keyhole, and is kept in position to receive the key by means of a projection formed with a recess in which a pin on the revolving plate rests. The projection is formed on a curved bar, one end of which is free to move on a pin or stud, while the curved end rests in a segmental recess formed in one arm of a bell crank lever; the other arm of this lever is bent, and the end abuts against a tappet fixed on a rod held in the sides of the lock plate. This rod carries another tappet, at right angles, or nearly so, to that first-named, and is pressed against by a spring which rests upon the lock plate. The revolving plate carries a projecting arm, and, on the key being turned, it carries the plate with it, and the arm entering a notch in the bolt, and the motion of the key being continued, shoots the bolt. The key, in carrying the plate round comes in contact with the segmental recess in the bell crank lever, forces it back, and causes the tail to press upon one of the tappets on the rod before named; the pressing in of this tappet depresses the other tappet, and forces down the spring, and this tappet pressing at the same time upon one arm of a lever, raises the opposite arm, which is hooked, free from a locking lever, and the motion of the key being continued brings the arm on the circular plate into a notch on the tail of the locking lever, whereby the face of this lever, formed with a crutch, is forced behind and into a recess made in the bolt, and holds it secure until the motion of the key in the reverse direction, acting through the arm on the revolving plate, the bell crank lever, the tappet rod, and hooked lever, releases the locking lever; whereupon the hooked lever engages into the locking lever, releases the crutch from the bolt, and allows of the bolt being drawn back by the arm on the revolving plate entering the notch in the bolt. The working parts of the lock are at such a distance from the keyhole, that they are inaccessible, or nearly so, to any instrument for picking the lock. *Patent abandoned.*

952. A. V. NEWTON. *An improved construction of blowing apparatus.* (A communication.) Dated April 15, 1863.

According to this invention, a novel form of centrifugal blower is constructed, capable of being used singly or in combinations of two, three, or more blowers, the same being mounted one behind the other in the same case, but in separate chambers, which communicate the one with the other by central openings in the partitions which divide the case into the chambers. *Patent completed.*

953. T. B. E. FLETCHER. *Improvements in apparatus for collecting the solid portions of sewage.* Dated April 15, 1863.

Here a receptacle or pan is placed in any position where it will intercept the passage of the sewage from its source to the outlet; this receptacle is furnished at or near the top with two bends, one for the ingress of the sewage, and the other for the egress of the fluid portion only, the latter being provided with a grating to prevent solids from being washed through. *Patent completed.*

954. J. B. WATTS. *An improvement in steel sword hilts.* Dated April 16, 1863.

This consists in forming the "oval centre" for steel sword hilts of a separate piece, and of any suitable metal, at the same time removing that portion of the metal of the hilt where the oval centre requires to be situated, and then fixing the separate piece of metal in such place in the sword hilt either by soldering, rivetting, or otherwise. *Patent abandoned.*

955. J. L. McLAY. *Improvements applicable to mariners' compasses.* Dated April 16, 1863.

The object of this invention is to render the mariners' compass independent of local attraction generally when placed on board an iron ship, and consists in surrounding the compass with a ring or zone of brass, to which is attached a number of curved magnets placed at equal distances from each other, with their poles pointing outwards. The needle is placed so as to be in the plane of the centre of the length or breadth of the curved magnets which move with the compass bowl. *Patent abandoned.*

956. J. BAGGS and W. SIMPSON. *Improvements in purifying and treating coal gas, sulphuretted hydrogen, and other gases containing sulphuretted hydrogen, and in obtaining sulphur, sulphuric and other acids, in such treatment.* Dated April 16, 1863.

The main objects of this invention are twofold—firstly, the depriving of coal gas of elements which render it injurious to the animal and vegetable kingdom; and secondly, the manufacture of useful products from or with the elements of which the coal gas has been deprived. The patentees cause the gas to come in contact with metallic compounds, by blowing or otherwise, whereby the injurious adulterative matters are separated by decomposition or appropriation. The metallic compounds employed are mainly metallic oxides and salts, whether neutral salts, super-salts, or sub-salts, having a strong affinity or attraction for sulphur, carbonic acid, and other impurities; and which are themselves susceptible of renovation or recovery. The oxides and salts of copper, lead, magnesia, and other bases may be used for these purposes. *Patent completed.*

957. C. TERRETT. *Improvements in preventing incrustation in steam boilers.* Dated April 16, 1863.

This invention relates to a composition for preventing incrustation in steam boilers, and consists in a combination of terra japonica (Gambier), or Mimosa japonica, divi divi, cutch (catechu), and myrabolams. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 30, 1863.

1625. J. G. Jennings, Palace-road, Lambeth, sanitary engineer, and M. L. J. Lavater, Bath-street, Newgate-street, india rubber manufacturer. Improvements in stoppers and lids or covers for jars, bottles, and other vessels, also in closing and fastening other articles.

Dated July 3, 1863.

1653. H. Broadhead, captain R.N., and G. Murdoch, inspector of machinery in the Royal Navy, Portsmouth. Improvements in breech-loading ordnance, and gun carriages.

Dated August 12, 1863.

1993. R. Wappenstein, Manchester, engraver. A new method of preventing forgery of bankers' cheques and other documents by the use of a stamp, and a new apparatus whereby the issue of a stamped document is controlled.

Dated August 31, 1863.

2151. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in the mode of, and apparatus to be used in, sewing by machinery. (A communication.)

Dated September 3, 1863.

2177. N. Bailly, Vesoul, France, agent. Improvements in the application of rolling friction to the axle-boxes and journals of running shafts and axletrees of machines and vehicles of all descriptions for lessening the resistance to the motion. (Partly a communication.)

Dated September 24, 1863.

2359. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in the manufacture of gunpowder and powder for blasting purposes. (A communication.)

Dated September 28, 1863.

2376. T. Lowe, Brighton. An improved break for railway and other carriages.

Dated October 15, 1863.

2524. R. Bewley, jun., Uttoxeter, ironfounder. Improvements in wrenches.

2528. H. W. Hart, Fleet-street, engineer. Improvements in apparatus for suspending T and other like fastenings and articles to which they are applied.

Dated October 17, 1863.

2538. S. Berrisford, Stockport, engineer and machinist, and W. Ainsworth, overlooker. Certain improvements in looms for weaving.

Dated October 19, 1863.

2555. A. Budenberg, Manchester. An improved blasting powder. (A communication.)

Dated October 20, 1863.

2576. W. N. Hutchinson, Plymouth, major-general. Improvements in ordnance.

Dated October 21, 1863.

2579. T. C. Clarkson, 56, Stamford-street, Blackfriars, manufacturer. Improvements in the manufacture of saddles and harness, and in materials for, and in ornamenting the same, which improvements are applicable for parts of carriages, dress, and coverings for the head, and other articles.

2586. E. Alcan, King-street, City, merchant. An improved method of figuring and ornamenting cloths and other fabrics and apparatus employed therein. (A communication.)

Dated October 22, 1863.

2598. J. W. Friend, Freemantle, Southampton, and B. F. Weatherdon, Kingston-on-Thames, civil engineer. An improved valve and valve gear for regulating the passage or flow of fluids.

2602. J. Weems, Johnstone, Renfrew, engineer. Improvements in machinery, apparatus, or means for drying, cleaning, and cooling grain and other vegetable products.

2603. A. Kinder, 20, Cannon-street, engineer, and J. Inglis, Ellesmere-road, Old Ford, engineer. Improvements in the manufacture of metallic foils, and in the apparatus to be employed therein.

2604. B. Noakes and F. J. Wood, Bermondsey, iron cask manufacturers. Improvements in the manufacture of metallic casks, bottles, and other similar vessels, and in machinery employed therein.

Dated October 23, 1863.

2611. J. L. Jürgens, 4, Noel-street, Islington, navigator. Improvements in vessels of war.

2614. A. J. Martin, 2, Vernon-terrace, Roman-road, North Bow, chemist. An improved burner for burning petroleum, paraffin, or other hydrocarbon oils, consuming the smoke without the use of a draught chimney.

2619. F. Tolhausen, 17, Faubourg Montmartre, Paris. An improved mechanism for regulating the working of springs. (A communication.)

Dated October 24, 1863.

2630. W. Locke and J. Warrington, Kippax, near Leeds, coal owners, W. E. Carret, W. E. Marshall, and J. Telford, Leeds, engineers. Improvements in the working and mining of coal, minerals, and earthy matters, and in the machinery, apparatus, and means to be employed therein.

2634. B. Browne, 49, King William-street, City, civil engineer. Improvements in sewing machines. (A communication.)

Dated October 26, 1863.

2636. R. Littleboy, 2, John's-terrace, St. Leonard's-road, Bromley. Improvements in the manufacture of nosebags.

2638. F. Parker, Cambridge, carriage builder. Improvements in carriages.

2640. S. J. Healey, Manchester, engineer. Improvements in water gauges applicable to steam boilers and other purposes.

2642. J. Nicholas, Newton, oil refiner. Improvements in treating Canadian petroleum and other mineral oils of a similar nature.

2646. A. Blake, Newport, Monmouthshire, brewer. An improved refrigerator for cooling worts for brewing, or other liquids requiring cooling, and for improving brewers' refrigerators now in use.

Dated October 27, 1863.

2648. J. Marshall, 126, Pentonville-road, civil and mechanical engineer. Certain improvements in the expression of oil from oil-yielding substances, and in the production of oil cake and other residuary matters.

2654. J. Hutchinson and J. Hollingworth, Dobcross Saddleworth, machine makers. Improvements in means or apparatus employed in weaving.

2656. R. Smith, 24, Higher Chatham-street, Manchester, machinist. Improvements in doubling and winding machines.

2658. M. W. Carr, Knoll, Blackheath, civil engineer. Improvements in the manufacture of wooden sleepers for railways.

Dated October 28, 1863.

2660. W. Wanklyn, Albion Mills, Bury, cotton spinner. Improvements in apparatus for opening and conditioning cotton and other fibrous substances.

2662. A. S. Coronel, 256, High Holborn. An improved preparation of tobacco for fumigating purposes.

2664. S. Procter, Elsecar, mechanic. An improved instrument for extracting corks from bottles.

2665. E. Oldfield, Adelphi Iron Works, Salford, machine makers. Improvements in self-acting mules for spinning and doubling cotton and other fibrous materials.

2666. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. An improvement in clasps for portemonnaies, pocket-books, bags, and other like uses. (A communication.)

2668. J. and J. Cavanah, 21, Parron-street, Paddington, Liverpool. Improvements in machinery or apparatus for

making bricks and tiles, applicable also for washing and drying clay.

2670. W. Nall, 1, Wharf-street, Leicester. Improvements in ornamenting glass and sheet gelatine.

2671. G. E. Donisthorpe, Leeds. Improvements in apparatus used when getting coal and other minerals.

2672. R. B. Jones, Limerick, gentleman. Improvements in portable cooking apparatus.

2673. J. Kennedy, Whitehaven, shipbuilder. Improvements in the construction of ships of war and other vessels and in masting and rigging the same.

2674. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in instruments for taking astronomical and other observations. (A communication.)

Dated October 29, 1863.

2676. O. C. Evans, Manchester. Improvements in digging machinery.

2677. J. R. Johnson, 31, Red Lion-square. Improvements in the manufacture of lubricating compounds.

2678. J. Rawlings, Carlton-hill East, gentleman. Improved means of attaching cords to window sashes.

Dated October 30, 1863.

2679. A. R. L. M. Normandy, Odin-lodge, King's-road, Clapham-park. Improvements in the manufacture of playing cards.

2680. F. N. Gisborne, 3, Adelaide-place, London-bridge, engineer and electrician. An improved composition for coating ships' bottoms.

2681. J. Nash, 37, Princes-street, Leicester-square, furniture dealer. An improved mattress for beds.

2683. H. Cochrane, Ormesby Iron Works, Middlesborough-on-Tees, Yorkshire, engineer. Improvements in surface condensers, also applicable to the refrigeration or cooling of fluids.

2684. W. M. Neilson, Glasgow, engineer. Improvements in taps, cocks, or valves. (A communication.)

2685. W. Gadd, Nottingham, lace manufacturer. Improvements in machinery or apparatus for the manufacture of bonnet and cap fronts, which improvements are also applicable to the production of ornamental effects to other trimmings for wearing apparel.

2687. M. J. Roberts, Pendarren-house, Crickhowell, esq. Improvements in apparatus for oiling wool.

2688. G. Rosselet, Rue Sainte Appoline, Paris. Improvements in apparatus for sustaining and raising ships or vessels, applicable also as life-buoys.

2689. A. Turner, Leicester, elastic web manufacturer, and W. E. Newton, Chancery-lane, civil engineer. Improvements in looms for weaving terry and cut pile fabrics, parts of which improvements are also applicable to other kinds of looms.

2691. A. Turner, Leicester, elastic web manufacturer. Improvements in looms for weaving.

2692. W. Verran, Penryn, Cornwall, mechanical engineer. Improvements in machinery for obtaining motive power by means of steam.

2693. H. Clow, Bland-street, Dover-road. Improvements in ovens.

2694. G. F. Busbridge, East Malling Mills, Kent. Improvements in apparatus for feeding sheets of sized or unsized paper to a drying machine.

2695. J. Brigham and R. Bickerton, Berwick-on-Tweed, implement makers. Improvements in reaping and mowing machines.

2696. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the manufacture of soap. (A communication.)

Dated October 31, 1863.

2701. J. Rennie, Birmingham, manufacturer. Improvements in the manufacture chandeliers, lamps, and other apparatus employed in distributing light.

2703. J. Getty, Temple-street, Liverpool. Improvements in building ships and vessels.

2705. W. Pope, Bristol, engineer and millwright. Improvements in machinery for breaking or crushing stone.

Dated November 2, 1863.

2711. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in clock-work movements. (A communication.)

Dated November 3, 1863.

2717. R. Eaton, Stockport, machinist. Improvements in machinery for ruling or marking leather.

2719. J. P. Booth, Cork, feather purifier. Improvements in beds and bedding.

Dated November 4, 1863.

2723. P. A. Sautreuil, Fécamp, France. An improved apparatus for the lubrication of bearings, shafts, or other parts of machinery subject to friction.

2725. J. Thomas, Battersea, ironfounder. Improvements in preparing ores and earths containing copper for smelting.

2731. J. A. Barral, officer of L. d'Hr., chemist, and L. A. Cochery, land owner, 10, Rue de la Fidelité, Paris. Certain improvements in the manufacture of manure.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated November 4, 1863.

2728. J. Tangye, Birmingham, manufacturer. Improvements in portable hydraulic shearing and rivetting machines.

Dated November 7, 1863.

2768. J. K. Hoyt, New York, United States. Improvements in revolving firearms. (A communication.)

2779. G. Haseltine, 12, Southampton-buildings, Chancery-lane, civil engineer. An improved machine for bending metallic pipes or spouts. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, November 17, 1863.

[illegible]. J. G. Jennings and M. L. J. Lavater. Stoppers.

16[illegible]. H. Broadhead and G. Murdoch. Breech-loading ordnance.

1665. J. Gimson. Shuttles.

1676. J. M. Croft. Propellers.

1683. W. S. Bruce. Lucifer matches. (A communication.)

1648. E. Edwards. Finger plates.

1687. W. E. Gedge. Seats, chairs, sofas, and lounges. (A communication.)

1688. W. E. Gedge. Apparatus for milking. (A communication.)

1689. S. Robinson. Spring hinges.

1696. J. Gibson, S. Trulock, R. Trulock, and W. Trulock. Breech-loading firearms.

1697. P. A. L. de F. Moreau. Roofing. (A communication.)

1698. T. Preece. Seed drill.

1703. H. D. P. Cunningham. Working guns.

1706. J. Smith and S. A. Chease. Hydraulic engine.

1714. R. Agate. Skylights.

1715. W. E. Newton. Barometers. (A communication.)

1718. W. Tasker. Thrashing machines.

1722. J. J. Shedlock. Soil pits. (A communication.)

1728. W. Henderson. Ores.

1737. J. Barnes. Clipping off connecting threads in lace.

1738. R. A. Brooman. Cartridges. (A communication.)

1741. R. D. Dwyer. Vents.

1749. R. A. Brooman. Suspending chandeliers. (A communication.)

1750. R. A. Brooman. Gumming warp threads. (A communication.)

1771. W. Clark. Making paper transparent. (A communication.)

1786. G. Rand. Boiling and cooking.

1818. R. Weare. Water-closets.

1820. F. L. H. Danchell. Purifying water.

1858. J. Boyd. Imitation selvages.

1859. F. Tolhausen. Gun-barrels. (A communication.)

1871. A. Hector. Catching of fish.

1872. A. A. A. Baron de Rostaing. Iron and steel.

1924. E. A. Cotelle. Gas alcohol.

1981. J. G. Willans. Iron.

2022. G. Davies. Furnaces for heating glass. (A communication.)

2031. A. V. Newton. Printing. (A communication.)

2077. R. Thompson. Planing curved forms in iron.

2168. E. Collier. Crinoline fastenings.

2319. E. F. Rattier. Crinolines.

2442. E. Whitehouse. Wrought-iron shackles.

2448. E. Jones. Pumping water out of mines.

2522. H. A. Bonneville. Cleaning ships' hulls. (A communication.)

2577. T. Restell. Walking-stick umbrella.

2592. G. Cutler. Boilers.

2640. S. J. Healey. Water gauges.

2655. P. B. O'Neill. Salinometer.

2674. R. A. Brooman. Instruments for taking astronomical observations. (A communication.)

2683. H. Cochrane. Surface condensers.

2728. J. Tangye. Shearing and rivetting machine.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed November 13, 1863.

1243. A. Heather and J. Redfern.
1245. R. Fenner and W. H. Hight.
1253. R. Bunting.
1254. H. J. Olding.
1273. F. P. Warren.
1281. R. A. Brooman.
1335. F. R. Piltz.
1379. E. J. Jarry.
1447. W. Clark.
1836. C. Beslay.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2781. W. Roberts.
2789. R. Furnival.
2791. W. Robertson and J. M. Hetherington.
2801. P. Unwin, J. Unwin, and J. U. Askham.
2802. A. Henry.
2855. W. Cope, W. G. Ward, and E. Cope.
3765. F. Trouvé.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2706. J. Billing.
2743. J. M. Gilbert.
2798. A. V. Newton.

LIST OF SPECIFICATIONS PUBLISHED.

For the Week ending November 14, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
660	0 4	700	0 4	708	0 4	716	0 4	725	0 4	735	0 4
670	0 8	701	0 4	710	0 4	719	0 4	729	1 8	736	0 8
680	0 10	703	0 10	711	0 4	720	0 4	730	0 10	738	2 6
695	0 10	704	0 4	712	0 6	723	0 8	731	0 4	741	0 10
696	0 4	705	0 4	714	0 4	724	0 8	733	0 4	742	0 6
698	0 4	707	0 4								

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£ s. d.		£ s. d.	
Iron:—					
Welsh Bars, in London	per ton	7 10 0	to	0 0 0	2½ p c t
Nail Rods	do	8 0 0		8 10 0	
Hoops	do	10 10 0		0 0 0	
Sheets, single	do	11 10 0		0 0 0	
Staffordshire Bars	do	9 10 0		0 0 6	
Bars, in Wales	do	6 10 0		6 15 0	
Rails	do	7 0 0		0 0 0	nett
Foundry Pigs, at Glasg, No 1	do	3 0 0		3 6 0	
Swedish Bars	do	11 10 0		12 10 0	2½
Steel:—					
Swedish Keg, hammered	do	16 0 0		14 10 0	
Swedish Faggot	do	17 0 0		18 0 0	
Copper:—					
Sheet & Sheathing. & Bolts	do	105 0 0		0 0 0	
Hammered Bottoms	do	115 0 0		0 0 0	
Flat Bottoms, not Hamrd	do	110 0 0		0 0 0	
Tough Cake and Ingot	do	96 0 0		0 0 0	
Tile Copper	do	98 0 0		0 0 0	
Best Selected	do	101 0 0		0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8¼		0 0 9	
Fine Foreign	per ton	100 0 0		102 0 0	
Tin:—					
English Block	per cwt.	5 15 0		0 0 0	2½
do Bar	do	5 16 0		0 0 0	
do Refined	do	6 0 0		0 0 0	
Banca	do	6 2 0		6 3 0	nett
Straits	do	5 17 0		0 0 0	
Tin Plates:—					
Best Charcoal, I.C.	per box	1 9 0		10 0	
Second Quality	do	1 7 0		8 0	
Coke	do	1 3 6		5 0	
Spelter:—					
On the spot	do	18 7 6		0 0	nett
Zinc:—					
English Sheet	do	24 0 0		0 0 0	2½
Quicksilver	per btl.	7 0 0		0 0 0	3
Regulus of Antimony:—					
French star	per ton	35 0 0		0 0 0	2½

Timber, duty 1s. per load, drawback 1s.

Teak load	£12 0	£13 0	Archangel, yellow	£13 0	13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
„ yellow pine	3 10	4 10	Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0	Memel	10 0	15 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
„ birch	3 10	4 10	„ white	9 0	9 10
„ elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderhamn	9 10	10 0
„ fir	2 10	3 10	Christiania, per C., 12ft. by 3 by 9 in.		
Memel fir	3 5	3 10			
Riga	3 0	3 5	Christiania, yellow	21 0	23
Swedish	2 10	2 15	Deck Plank, Dantzic, per 40 ft. 3 in.	0	1 1
Masts, Quebec red pine	5 0	6 0			
„ yellow pine	5 0	6 0	Pumice Stone pr ton	5	9 0
Lathwood, Dantzic, fm	5 10	6 10	Oils, &c		
„ St. Petersburg	8 0	8 10	Seal, pale ...per tun	47 10	0 0
Deals, perC., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Sperm body	76 0	78 0
			Cod	66 0	6 0
			Whale, Sth Sea, pale	45 0	46 0
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	58 0	59 0
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	47 10	48 0
Yellow pine, per reduced C.			Palm, fine	37 0	37 10
			Linseed	40 10	0 0
Canada, 1st qual.	17 0	18 0	Rapeseed, Eng. pale	41 10	42 0
„ 2nd do.	11 0	13 0	Cottonseed	31 0	28 0

FRENCH & SMITH, Sworn Brokers,
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4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 27, 1863.

AUSTRALIAN TELEGRAPHY.

WE have just received a copy of the report on the progress and general condition of Electric Telegraphy in New South Wales, prepared by Mr. E. C. Cracknell, and laid before both Houses of the Australian Parliament during the recent session. Mr. Cracknell, as telegraph superintendent, is placed in a position to afford the fullest possible information, and he certainly has not been chary of communicating it. Although the report contains much that can only excite a local attention, it contains much to interest English readers as well; the funds necessary for the formation of the various lines which connect colony with colony, town with town, having been in many instances supplied by capitalists who have never ventured into the regions of the New World. It is satisfactory to learn that, as a commercial speculation, the extension of the telegraph system throughout New South Wales has been for the most part thoroughly successful; the lines in general being fully employed at remunerative charges. Very many extensions are proposed, and not a few in progress, the contract prices varying from £48 to £43 per mile. The length of the lines at work in the colony, at the date of the report, in April last, was 2,174 miles, the number of miles of wire being 2,539. When we consider that it is only five years since telegraphic communication was commenced in New South Wales, it must be admitted that the spirit of enterprise has not been absent in this important matter; while the profits show that the facilities for communication, placed at their disposal by the telegraph, have been fully appreciated by the public. The report, indeed, informs us that although "in the year 1858 this colony was far behind the sister colonies of Victoria and South Australia in the length of its lines, it can now boast of not only a greater number of miles of wire, but that it is the only Australian colony in which the electric telegraph returns a fair per-centage on the capital invested. The receipts, it seems, at nearly all the stations, show a steady increase, which is most encouraging, and augurs well for further progress. The public appear to evince increased confidence in this simple and expeditious means of communication; and when the works, which are now in progress, are completed, delays of a serious nature will seldom occur, and a still further increase in the revenue of the department may be expected."

The total capital invested amounts in round numbers to about £116,500—no inconsiderable sum for a thinly-peopled country like New South Wales. The net profit on this sum is stated to be £8,733, or, as nearly as possible, 7½ per cent. per annum. This is doubtless a very good result; but still better things may be looked for. Many of the intermediate stations, which are necessary for the maintenance of the through line, return little or no revenue as yet, while the formation of some of the branch lines has been too recent to permit much profit from them for the present.

As to the details involved in the daily working of the lines, Mr. Cracknell speaks boldly, and suggests improvements and alterations in an independent spirit which we admire. Many of our electricians will be surprised to learn that the Wheatstone's instruments, supplied from England in 1861, have not answered the purposes intended. They are apparently too complicated and delicate in their construction to be used by inexperienced operators, and cannot be made to work satisfactorily when a number of stations are connected in one circuit. They answer well enough, however, for short lines with only two terminal stations, and the report recommends, therefore, that their use be in future confined to short private lines, or branches from main lines to places which will not pay for a specially-trained operator. All the lines have worked well, and the expenditure for repairs has been trifling. The first section of the Northern Line, which is carried through a rugged and badly-timbered country, has given most trouble. The submarine cable at a place called Wiseman's Ferry, on the river Hawkesbury, has also been a source of great annoyance, the continuance of which has now been provided against by the substitution of masts and overhead wires. The mode of insulating all but the early lines has been very much improved; highly-glazed porcelain insulators, double umbrella, being now used, in place of the rough salt-glazed stoneware insulators. It is stated that the superiority of the former is rendered very manifest by the comparative ease and rapidity with which the lines so insulated can be worked in wet weather. For all future lines, and for repairs to those already constructed, much longer and larger poles will be used, the first cost of which will, perhaps, a little exceed those now erected, but they will eventually prove more economical, as the same poles, if 28 ft. long, when decayed near the surface of the ground, can be re-set, and will still be of sufficient length to admit of ordinary traffic passing under the wires. As an experiment, a number of wrought-iron posts have been imported; they consist of a galvanized wrought-iron tube, 15 ft. long, tapering towards the top, in which is fitted a 6-ft. wooden top carrying the cross-arms and insulators, the whole fitted into a cast-iron base 4½ ft. long, with cross-feet to keep the post in a perpendicular position; these are very light in appearance, and should be very durable; but their expense must be too great, we fear, to permit of their meeting with anything like extended adoption, even on the railway lines, as proposed in the report.

Perhaps the most important, certainly the most interesting, portion of Mr. Cracknell's Paper is a kind of appendix, embodying a proposal laid by that gentleman before the Secretary for Public Works, for the extension of the line of electric telegraph to Northern Australia, and its ultimate connection with the Dutch settlements, India, and Europe. Telegraphic communication at present exists, and is in daily operation, between London and Bagdad, and from Kurrachee to Rangoon, in the Bay of Bengal. The gaps to be filled up are from Bagdad to Kurrachee, a distance of 1,410 miles, arrangements for which have been entered into; and the contract for the Persian Gulf cable has been given long since, as our readers are aware, to Mr. Henley, to be ready and laid by the end of the present year. The next length to be provided for is from Rangoon to Singapore, a distance of 1,090 nautical miles. This section the Indian Government have consented either to subsidize or assist in carrying out coincidently with the other extensions. The Dutch Government have entered into arrangements with Mr. Gisborne for the supply and submersion of a new cable, on the most approved principle, between Singapore and Batavia, which, in connection with their existing land lines, will in less than two years establish communication to the east end of Java. The next link is the Australian section, which Mr. Gisborne proposes should terminate either at Brisbane or Broad Sound; but now that the northern colony, Queensland, is daily becoming more settled, a land line would be perhaps more suitable. Mr. Cracknell proposes the following as the best route:—

The Queensland Government to extend their existing lines to Rockhampton, and from thence to, say, Peak Downs or some other point to be determined on, within the settled districts, to be then continued jointly between the colonies of New South Wales and Queensland, to, say, 138 deg. east; from thence to Van Diemen's Gulf, to be constructed by the South Australian Government, or, in the event of that Government not approving of this proposal, the line should terminate at the Albert River, Gulf of Carpentaria (which would reduce the land line, to be constructed by the two colonies, to 700 miles), and there join the submarine cable, which would touch at Port Essington, and continue to Coepang and Cape Sedano, East Java; the distances being as follows:—

From Albert River to Port Essington	660	knots.
From Port Essington to Coepang	525	„
From Coepang to Cape Sedano	590	„

According to another scheme proposed by Mr. Todd, the line would be carried overland direct from Adelaide across the continent to Van Diemen's Gulf, an estimated distance of 2,000 miles. The proposal would doubtless have been more feasible were the country settled; as it is, there are no intermediate places of sufficient importance to assist the receipts. Mr. Cracknell has, therefore, apparently good grounds for preferring the line which he proposes himself. For the construction of the land line he recommends an entire change from the present system:—"Thus—instead of thirty posts, 23 ft. in length, to the mile, I would place only ten posts, 40 ft. high, with a light steel wire conductor of the same size as the *over-house* wires now used by private firms in London, No. 11 wire gauge. I would also substitute a bell-shaped ebonite insulator instead of the more expensive and fragile articles now in use, and a zinc rain shield round the post, about a foot from the top. By this means a dry zone can always be insured, and the highest points of insulation attained."

The advantages to be derived from telegraphic communication with our Australian colonies can scarcely be over-estimated. The total through charge, for a twenty-word message, from London to Melbourne, *via* Asia Minor, would not exceed £6. The expenses of constructing the line through its various portions would not be very heavy, and might be ultimately defrayed by a joint Government subsidy, extending over a period of, say, thirty years. Mr. Gisborne proposes to convey free messages for the several Governments to the extent of the subsidy. This liberal offer reduces the whole matter, as far as the Australian colonies are concerned, to the construction and working of 700 miles of land line, the former of which (at a cost of £70,000, bearing an interest of 5 per cent.) would form an annual charge of £3,500, and with the working expenses, which are estimated at £9,800 per annum, would be provided by the two colonies; against these would be placed the profits derived from the undertaking. Mr. Cracknell considers the submarine cable, proposed by Mr. Gisborne, to be one well adapted for the route intended; it has a much larger conductor than the original sample; it is much heavier, and is provided with an outer coating of equal parts of jute, bitumen, and hydraulic mortar, which will prevent the corrosion of the protecting wires, and admit of the cable being lifted for repairs without fear of fracture. The shallow soundings, throughout the entire distance, are also

much in favour of the successful laying and working of the cable—a depth of more than fifty fathoms being seldom attained; the distances are also very convenient, being only 660 knots for the longest length—that between Albert River and Port Essington—which will admit a speed of not less than from twenty to twenty-five words a minute.

THE "BELLEROPHON" TARGET.

A PARAGRAPH describing the armour proposed to be applied to Mr. Reed's iron frigate "Bellerophon," which has more than once gone the round of the press, propounds the plan as something new, and as Mr. Reed's invention. In this statement there is a double error, affecting the novelty and design of the system, which is to be tested in the target constructed by the Millwall Company, and now being erected at Shoeburyness for trial, under the supervision of Mr. Baskcomb, the Admiralty Inspector.

Shortly after the conclusion of the armour plate experiments during the past summer, the Chief Constructor and Mr. Baskcomb paid a visit to the practising-ground at Shoeburyness, where they inspected the dismantled targets, and examined carefully their construction, as well as the effects of the projectiles, which had been fired at them. One of the targets consisted of three plates, supplied by Messrs. Brown and Co., of Sheffield, fastened to an iron frame and teak backing, forming a structure which is the type of the proposed "Bellerophon" armour. The two Admiralty officials conceiving that this combination of iron and wood exhibited greater powers of resistance than any other, Mr. Reed determined to adopt the plan.

Our naval, military, and scientific readers will remember the trial of the Armstrong and Whitworth shells, and the heavy 150 and 300 pounder solid shot, which took place at Shoeburyness the 17th March last, and which was reported in the MECHANICS' MAGAZINE a few days after. It was the target referred to at which those missiles were fired.

The three plates differed in thickness—one being 5½, one 6¼, one 7¼ in. Half the length of the plates was left hollow, the other half was backed with teak 9 in. thick, supported behind by iron skin plates 2 in. thick, fastened to iron frames of about the same dimensions and the same distance apart as those proposed for the "Bellerophon." Taking 5½-in. armour plates, increasing the wood-backing to 12 in. (variously stated 10 to 12 in.), we have the combination, of which the invention is ascribed to Mr. Reed, but which really was the result of the accidental circumstance, that the three plates in question, were fastened to the frame of the Samuda target, of which the skin plates were 2 in. thick.

From the result of the experiments on the Brown-Samuda structure, we may form a pretty correct notion what will be the power of resistance of the "Bellerophon" target. Whatever it may be, in comparing it with other systems, we must look to the respective weights of the materials. The weight of the "Warrior" target, consisting of 4½-in. armour plates, 18 in. of teak backing, and ¾ in. skin plates, was 346 lbs. per superficial foot; that of the "Bellerophon," having 5½-in. armour plate, 12 in. of teak, and 2-in. skin plates, will be about 400 lbs., or nearly 60 lbs. per foot more. This is a great addition to the strength of the armour; it is, of course, calculated to offer greater resistance than the "Warrior" section; and before the "Bellerophon" armour can be fairly contrasted wit any of the systems which have been experimented upon, or may be proposed, the latter ought to be tested by giving them the same weight of materials. In all trials in competition with the "Warrior" plan, the weight was limited by the authorities to 346 lbs. per foot. It is to be expected that, with 60 lbs. per foot more, the resistance of the mass will be greater; but as regards the armour plates themselves and the backing, irrespective of the skin plates, we have as a guide the experiments tried at Shoeburyness on the "Minotaur" target, of which the armour plates were 5½ in., and the teak backing 9 in. thick. The result was anything but encouraging; for the plates, although 5½ in. thick, were more damaged and more extensively buckled than the the 4½ in. "Warrior" plates. So unsatisfactory at the time was this trial considered, that the Admiralty proposed to the contractors for the "Minotaur," "Northumberland," and "Agincourt" two new plans of armour for those vessels, and asked for estimates of the expense. An increase of some £8,000 or £10,000 on each ship being demanded, the Admiralty abandoned the new plans, which, of course, were thought to be an improvement, otherwise they would not have been proposed. The three ships were ordered to be armour-plated in accordance with the original design, which, as we have stated, on being tried in the form of the "Minotaur" target had proved to be a failure. Thus is the defence of England on the seas trifled with and imperilled.

Whilst millions are squandered in constructing experimental ships and guns without previous trial, in an ill-considered spirit of economy, a system of protecting ships proved by experiment to be defective is adopted in preference to a more effective one. Of what use are our costly gunnery experiments if the teaching they afford is disregarded?

STEAM TO AMERICA.

IF the number of new joint-stock companies which daily start into existence can be taken as evidence, this grand old country of ours is suffering just now from a plethora of wealth—a superabundance of capital, in fact, for which it is difficult to find an investment. It is far from likely that all the gentlemen who set schemes on foot, are possessed of the Midas-like faculty of turning that which they touch into gold. Yet, among the many projects, some of them wild enough in all conscience, now before the public, we find at least a few distinguished by a sound mercantile appreciation of all those points necessary to pecuniary success. Mines, banks, railways, hotels, come in for a fair share of patronage, and, perhaps, a little of the latest, the establishment of new steamship lines begins to attract the attention of those who wish to expend their money to advantage. Seven-and-twenty years ago the project for establishing a line of steamships between this country and America, was first announced to the world. The "Savannah," and the "Curaçoa," had already performed the voyage, and thereby demonstrated the practicability of the enterprise, in a nautical and mechanical sense. As to the commercial aspect of the question, direct evidence was wanting. The scheme was a new thing in the world, the like of which had never gone before; and in consequence the possession of experience was out of the question. Many were the debates, turbulent the discussions, which followed on the proposal. At length, eight steamships were placed on the line, and for some time kept up the communication between the countries, with a doubtful kind of success as far as the passages were concerned, and with a certain and ruinous loss to their owners. It soon became evident, in short, that such a line could not possibly succeed under then existing arrangements, without the aid of a Government subvention. The Cunard line then started into existence. Every circumstance connected with it is too well-known to require comment; but we may remark that the failure of the first scheme for Transatlantic communication by the aid of steam, was sufficient to prevent for many years, the setting on foot of any other which proposed to rest entirely on its own resources.

Granting that an ocean steamship finds full employment, the profit to be derived from her voyages in the regular course of trade, will depend mainly on her working expenses, and her available carrying capacity. A large proportion of the former are absorbed in the purchase of fuel and the repairs of the machinery. The latter is determined with a given tonnage, by the quantity of coal which it is necessary to take on board at one time; what this may be, depending again on the length of the voyage, the speed maintained, and the good or bad qualities of the engines. What is true of one vessel thus far, may be applied to an entire fleet; and it follows that, in the present day, thanks to the improvements which the steam-engine has received, the necessity for a Government subsidy depends almost wholly on the observance of certain conditions as to speed, with the neglect of which the want of pecuniary aid at once disappears. Such was not the case, however, in the infancy of steam navigation. The maximum speed attained seldom exceeded that of clipper sailing ships. In the steady maintenance of a certain velocity, notwithstanding adverse gales and boisterous seas, resided the only superiority of steam over wind as a means of propulsion; and this power could only be obtained by the use of ponderous machinery, and full cargoes of coal which absorbed all the tonnage which should have been available for merchandise. The profitable load carried was of course reduced to a minimum, and thus the subsidy became absolutely essential to the maintenance of the mail service. The result of every improvement in steam machinery has been hitherto except in exceptional cases, an increase in the speed maintained, and seldom or never a reduction in the quantity of fuel carried. The policy of this system may be questioned but not overturned, so long as it is confined to the postal service. Mails cannot be conveyed at too high a speed; and the revenues of the Post-office are ample enough to meet even greater demands than those made on them now. But when we consider the questions involved in the conveyance of goods and passengers alone, we find that great speed is no longer a thing of paramount importance; and it becomes a simple matter of calculation to determine exactly how much it must be reduced to enable a steamship line to dispense with the aid derived from a Government subsidy.

A project for the formation of a new Translantic Steamship Company has recently been brought before the commercial world. The Inman line appears to pay its way pretty well without external aid, although the engines employed are not remarkable for economy, and a very fair speed is maintained. Finding a *point d'appui* in the deductions which may be drawn from this fact, the projectors of the new line propose to construct ships of that size which experience has demonstrated to be best adapted to the requirements of the service which they will undertake, fitted with engines combining the most recent improvements under the most compact form. As the attainment of an excessive speed is deemed un-

necessary, the consumption of fuel will be extremely moderate; and little doubt is entertained that the ships will, in consequence, prove highly remunerative to their owners, without the aid of any subsidy whatever. It is out of our province to consider the prospects which such a line enjoys of full cargoes and plenty of passengers; but granting that these can be procured, either by a slight reduction on existing tariffs, or by providing increased accommodation, there is no reason why the scheme should not be successful. The mail steamers, as recent events have proved, keep time, at a considerable risk; their velocity being maintained now and then with an enterprise which merges into rashness. The danger encountered from fog or iceberg is seldom regarded as of much importance when compared with advantages to be derived from the saving of a few hours in the time required for the passage. We presume that all this is taken into account by the underwriters. The machinery, too, of these boats is taxed to the utmost limit of safety, and their coal bills are of course very heavy. A given weight of engine will produce more power when the steam follows the piston with a full pressure throughout the stroke, than it will when expansion is largely employed. Speed is paid for by the Government, and speed must be got, no matter at what expense of fuel. Any economical expedient which would reduce the gross power of the engines, is therefore regarded as totally inadmissible in conducting the postal service; but the case is far different with vessels not bound to time. The uninitiated have little idea of the saving in fuel which is effected by a very trifling reduction of speed—a saving, indeed, very much greater than anything which mere mechanical improvements in the construction of the engines can possibly effect. If we take the case of a great ocean steamer, of the "Scotia" or "Persia" class, for example, we will find that the hourly consumption of fuel per indicated horse-power is not much, if anything, under 4 lbs. The distance run per trip is probably 3,000 knots; and in order to accomplish this in nine days or thereabouts, a speed of 14 knots must be steadily maintained. This will require the exertion of probably 4,000-horse power, and a gross consumption of fuel equal to about 1,500 tons in the same time. This varies, however, as the square of the speed, if we disregard time and base our calculations on the performance of each separate voyage. Consequently, by simply reducing the speed to, say, 10 knots per hour, for the sake of illustration, and increasing the whole duration of the trip from 9 to 12·5 days, the consumption of fuel will be reduced in the proportion of 10^2 to 14^2, or as 100 is to 196. In other words, instead of 1,500 tons, about 765 will suffice for each voyage. The sea-going expenses of the ship—such as the coals and maintenance of the crew and passengers—will, of course, be in direct proportion to the number of days which she remains at sea, and therefore will be augmented in the ratio of the reduction in speed, an item probably far overbalanced by the reduction in the amount paid for coals, leaving the profits to be derived from the additional 700 tons of cargo space as clear gain to the owners.

There is, however, a limit to this reduction in speed which cannot safely be overstepped, and steam-engine economy, therefore, becomes a matter of vital importance to any company working a line of steamers depending wholly on its own resources for the settlement of the great question of profit and loss. In the calculation which we have just made, we have reckoned on a consumption of 4 lbs. per horse-power per hour of good coal; and with the side, lever engine, surface condensation, and its attendant evil "blowing off," it is not likely that it can ever be much less. Any saving in the weight of fuel carried, permits the use of a heavier engine. Machinery of sufficient size to propel the ship at the required speed, even when the principle of expansion is extended to the utmost rational limit, can then always be employed, and the economy of fuel advanced a step further by reducing the hourly consumption from 4 lbs. to 2·5 lbs. This is no visionary idea. Many of the Mediterranean steamboats, fitted with Maudslay's three-cylinder engines, get on very well with this allowance, and that with very simple machinery, involving nothing occult in its principles or management. Keen competition between companies who have no fatherly Government to assist them in their difficulties, quickly engenders a warm appreciation of the merits of coal-saving machinery; and it is not perhaps too much to say that the commercial success of many an enterprise of the kind under consideration, has resulted from the skill of the engineer on whom the construction of the engines has devolved.

As to the direct means of propulsion employed, we cannot think the adoption by an unsubsidized company of the paddle-wheel as very desirable. The engines absorb the most valuable cargo space by their position on board; and they are, for the most part, very heavy, from the great size rendered necessary by a slow piston speed. The screw is preferable in every way, as it permits of the use of sails to any required extent, and, in consequence, very fast passages may be performed, even with engines which class between auxiliary and those of full power. For the very highest speeds the paddle is at present preferred: how much longer it will enjoy this favour, it is not easy to say; but it should find no place in a fleet destined for moderate velocities.

Not the least sensible feature of the proposed undertaking, is that of providing for the carriage of sufficient coal to last the double voyage, out and home. Coaling at a foreign port is a serious item of expense. It is difficult to meet with any coal equal to that produced by our own mines; and the cost and risk of sending a cargo on a long sea-voyage to a distant port, there to be unloaded and loaded again, is by all means to be avoided. American coal is very inferior to ours as a rule; while recent events have raised its price to a degree never dreamt of by the wildest speculators. According to recent quotations, none could be procured at much under 11 dols. per ton, and it was expected to rise to 25 dols.! This pressure may be only temporary; but it is well to provide not only against the consequences of its continuance, but its recurrence. There is really nothing to prevent a steamship of a couple of thousand tons burden carrying fuel enough to last her some twenty days, provided that all the necessary arrangements are made beforehand; and we may rest assured that, in the capability of doing so, resides an element of commercial success which will amply compensate for a slight diminution in speed.

THE ORDNANCE REPORT, 1863, CONDENSED; AND CONCLUSIONS FROM IT.

No. III.

THE ELSWICK COMPANY AND ITS COMPETITORS.

BY an *àpropos* coincidence, on Friday last, the day our Condensed Report of the Ordnance Committee showed the preferential position of the Elswick Company over all competitors, an account was published, in the *Times*, of experiments at Shoeburyness with a 600-pounder 22-ton Armstrong gun on the shunting principle. It is not, at present, our purpose to make any comment on the performance of that cumbrous piece of ordnance, or to consider its value for the service. Time and further experiments will show, whether it will be more successful than the other products of its constructor; or, whether like them, when fully tested, it will, as regards efficiency for the military or naval service, prove to be practically a failure. This monster gun produced at the Elswick factory, and ordered and paid for by the Government, is an illustration and corroboration of the favour shown by the War-office to the Armstrong party, to the exclusion of other ordnance manufacturers.

The preference and favour are all the more reprehensible, because the principle called "the shunt"* has been tested by the Ordnance Select Committee in competition with other plans of rifling, and proved, by their own report, to be the most destructive to the gun out of twenty trials of different systems. In our last number we showed, from the evidence, that in the experiments referred to, the Armstrong shunt burst at the fourth round, and the Blakeley and Bashley Britten rifled gun stood 133 rounds. The experiments which gave these results were with cast-iron guns; but they were *comparative*, and in principle applicable to wrought-iron guns. In the face of the decisive superiority of the Bashley Britten rifling over the Armstrong, the Elswick Company received an order to make a 600-pounder shunt; and Captain Blakeley, who offered to make and lend to the Government a heavy wrought-iron gun for trial, at his own expense, met with a flat refusal. Who is answerable for this disregard of the teachings of costly experiments at the public expense—this persistent official patronage of one man and his co-partners, to the sacrifice of the national interest? This act of the Government, and the partial and exaggerated report in the *Times* of the alleged satisfactory nature of the experiments with the 600-powder shunt gun, seem to indicate a determination, on the part of the authorities, to maintain the Armstrong monopoly.

We proceed with the evidence from the Ordnance Report. Captain Blakeley says:—"If Sir W. Armstrong makes the gun with a steel barrel, enclosed in a casing of coils, he makes precisely that gun which I had the honour of offering to the British Government in 1855—minus the rifling. My object in 1855 was to obtain a very powerful gun. In 1855 it was not the object of the Government to obtain a rifled gun." (No 4,650 to 4,654.) "I laid my plan before the Government in 1854. Sir W. Armstrong's first gun was made in 1855." (No. 4,677.) "The competition, preparatory to the introduction of the Armstrong gun into the service, ought to have been more generally known. I was not aware, till last year, that there was a committee sitting on rifled ordnance," (No. 4,621.) "I am afraid my correspondence with the War Department will show that I thought myself very ill-used, and that I got rather out of temper." (No. 4,663.)

Captain Blakeley thus proves three things:—1st. In 1854 and 1855 he proposed to the War-office to strengthen guns on the plan

* The term "shunt" was meant by the inventor to convey the idea that the ribs of the projectile shunted from one set of grooves to another; but no such action takes place. The shot is a mechanical fit, the ribs shift from their driving to their bearing side like any other mechanical fitting rifling. The peculiarity of the plan consists in the bearing surfaces of the ribs being lined with studs or strips of soft metal, a plan which is copied from the Prussian projectile.

afterwards introduced by Sir W. Armstrong. 2. He received no encouragement from the Government. 3. He received no intimation from the War-office authorities, and did not know till they were over, that competitive trials of rifled ordnance were to take place. He next proves:—"The 10th October, 1860, I wrote to the Admiralty:—'I am willing to supply Her Majesty's Government with guns (to penetrate armour plates) either at its expense, payment being contingent on the gun performing what I promised, or else at my own expense entirely.'" Being referred from the Admiralty to the War-office, he wrote to that Department, and not only offered to "construct a 200-pounder, but lend it for trial. The reply was, that the gun could not be tested." (No. 4,760-61-62.) "I also offered to contract for the supply of cannon, at a less rate than that charged by the Elswick Ordnance Company, and I was refused." (No. 4,762 to 4,764.) "I asked leave to compete for the production of rifled guns with Sir W. Armstrong and Mr. Whitworth. I offered to conduct all the experiments at my own expense. My offer was refused." (No. 4,746.)

Mr. Whitworth was also deluded with the trial of his polygonal rifling in old service guns. In 1856 and 1858, he rifled seven brass and three cast-iron guns, supplied to him by the War-office. The former met with considerable success. The latter—two 32 and one 68-pounder—proved the efficacy of the rifling for destructive effect, but burst after a few rounds with heavy charges, owing to the weakness of the cast iron. As a witness, Mr. Whitworth says:—"In 1858, after the cast-iron guns, supplied to me by the Government, were proved to be too weak, I received an intimation that no more guns were to be rifled on the Whitworth principle." (No. 2,469.) "No other reason was given." (No. 2,471.) "The 68-pounder fired its projectile completely through the 4-inch plate and timber side of the 'Alfred' in 1858 at 460 yards." (No. 2,485-86.) "In 1858, flat-fronted shot, from a Whitworth 32-pounder gun, penetrated a ship's bottom through 40 ft. of water and 8 in. of oak, 3 ft. below the surface."

Sir William Armstrong's "shunt" rifling, as applied to cast-iron guns, was a complete failure; yet he received orders to a great extent to apply the shunt principle to wrought-iron guns. Mr. Whitworth could not obtain the same privilege. The unsuccessful trials of his rifling with cast-iron guns, was the only reason given for not testing it with wrought-iron guns. Injustice to Mr. Whitworth and partially to Sir W. Armstrong are here plainly manifested.

Mr. Whitworth, referring to the trial of his gun the end of 1858, complains (No. 3,058-59) —"I never was present at any intended trial of my own gun to show the accuracy and range and every particular." "My complaint is, that I was not present at the trials, which I understood were to take place between my gun and Sir William Armstrong's; that I did not know of any such trials; and my gun, I maintain, had not a sufficient number of trials to enable the Committee to come to any conclusion respecting it."

Captain Noble proved that the Whitworth gun was tried only eight or nine times, and the Armstrong forty-five or fifty times, in the experiments that determined the adoption of the system which has cost the country so dearly. Captain Noble contradicted Mr. Whitworth as to his presence at the experiments, maintaining that he always had notice to attend trials, and, in fact, was present three or four times; but, being pressed, Captain Noble admitted (No. 3,093 to 3,094)—"I speak only from recollection; I know as a fact, we did not make notes at the time, whether the inventor was present or not; I can't show by the records in the office whether Mr. Whitworth was invited or not." Here is a question of credibility of witnesses, which the public must decide, remembering that Captain Noble is the partizan and partner of Sir W. Armstrong.

Mr. Whitworth's correspondence, printed in the Appendix, shows that from the 14th October to the 22nd December, 1858, he was unable to attend the experiments at Shoeburyness which, nevertheless, proceeded in his absence; and Captain Noble proves (No. 3,109) that the fuses which were wanting to make a complete trial of Mr. Whitworth's gun "could have been elaborated at Woolwich, but the Committee could not have got them before the trials, *being required to report immediately upon the subject*." Mr. Whitworth also reminded the Committee, at the time of the trials in 1858, "that three years ago (1855) he bored and rifled guns for the Government, from which he expected valuable data, by their being submitted to a regular course of practice, which he hopes will now be done, for" (up to the time of his writing, 1858) "these guns remained unnoticed." This refers to the brass guns he rifled for the Government. They would have stood, as they afterwards did, a long continuance of heavy firing; but that chance was not given to him at the proper time. The cast-iron guns having burst from their innate weakness, his system was hastily condemned for that reason, and no other.

With reference to the supply of projectiles for Mr. Whitworth's gun, at the competition with Sir W. Armstrong, a suggestive fact is brought to light by a letter, dated 30th Oct., 1858, addressed to Mr. Whitworth, by order of General Peel, directing him "to suspend preparation of the shells and shot ordered the 1st Oct., as the Committee on Rifled Cannon have a sufficient supply, and it is not probable any more will be required." This was written at the time the trial was in progress. When it was over, Mr. Whitworth was told his gun could not be fired with shells, because he had not supplied any.

The spirit in which these experiments were made, with the view of precipitating a decision, is manifested in the following passage of the instructions to the Committee:—"Major-General Peel does not wish time to be lost in the pursuit of further improvements." The Committee having been appointed 8th Sept., 1858, notice of the intended experiments was given to Sir W. Armstrong the 15th, and he replies the 17th September, giving a list of "seven guns, which may shortly be delivered at Shoeburyness," showing his complete state of preparation for the coming trial.

Mr. Bashley Britten was too late to give evidence before the Parliamentary Committee. At the request of the Chairman, he addressed to him a letter, dated 8th July, 1863, in which he refers to letters written by him to the War-office between the 1st April, 1859, and the 27th July, 1860, urging the propriety of stronger guns (than cast iron) being tried on his plan, and adds:—"Even up to the present time I have had no opportunities of demonstrating the advantages of my system of rifled ordnance, on anything like equal terms with other inventors." He goes on to state that "the Ordnance Select Committee, on the 27th July, 1860, recommended the construction of a heavy brass gun for the trial of my system. For this gun I was desired to furnish drawings of the rifling; this I did at once, but the gun has never been made."

Mr. C. W. Lancaster, having received a letter from the "Committee on Rifled Cannon," inviting him to furnish them with his views on the subject of rifling ordnance, replied the 15th October, 1858:—"I have to regret that the tenor of the replies received, in answer to my letters to the War Department, at present prevents my self-devotion to the Committee; when existing impediments are removed, by a recognition of my just claims, I shall have a pleasure to furnish the best information I can communicate."

Under a strong impression of the treatment he had met with, Mr. Lancaster no doubt conceived that justice would not be done to him, and declined having anything to do with the proceedings of the Committee. He, like Captain Blakeley and Mr. Bashley Britten, had just cause of complaint, on the ground that, in the trial of his system with cast-iron guns, he stood second at the top of the list, and he received no order from Government to construct a wrought-iron gun on his principle; whereas, as we have seen, Sir William Armstrong, whose shunt rifling was the most defective of all the plans tried, nevertheless was authorized to make several shunt wrought-iron guns for the Government account.

Mr. Westley Richards, a well-known gunmaker, who has devoted a good deal of attention to rifled guns, was examined at great length. He altogether condemns the experiments made by the War-office, and considers they have not been fairly conducted. In his evidence, he says:—"The guns were not, as they ought to have been, identical in construction, weight, calibre, and length, or in the projectiles, and charges with which they were fired." (No. 3,968 to 3,998.) "The rifling principle was the question to be tried." (No. 3,979.) "Competitive trials between guns should be made in public; any one taking an interest in the matter should be allowed to witness experiments before a final decision is come to about any particular gun." (No. 3,991.) "I think when scientific men ask permission to witness experiments, they ought to be allowed to do so. I was anxious to see some large guns tried. There was a trial of Sir W. Armstrong's, Mr. Whitworth's, and Mr. Lynall Thomas's large guns, and I was refused permission to see those guns fired." (No. 3,994 and 3,995.)

Commander Scott, R.N., a distinguished and experienced officer, and a practical artillerist, who was deputed by Government to watch and report upon certain experiments at Shoeburyness, and is the inventor and patentee of a system of rifling which has been successfully adopted, under his license, by Captain Blakeley, expresses dissatisfaction at the treatment inventors receive at the hands of the Ordnance authorities. He says:—"I see no way in which there has been any opportunity given of testing whether there was a better gun or not than the Armstrong." (No. 4,117.)

"Do you object then to the system that has been pursued with respect to inventors by the Ordnance Select Committee?"

"Certainly." (No. 4,118.)

"Will you state your reasons?"

"The guns have not been tried under the same conditions, nor were the projectiles alike in windage and weight." (No. 4,119.)

Referring to the injudicious mode of proceeding of the War Department, Commander Scott says:—"The Committee (which approved of the adoption of the Armstrong naval guns into the service) was appointed by the War Department. Colonel St. George was president—the president of the present Committee;

Captain Wiseman was vice-president, he being vice-president of the present Committee. Sir W. Armstrong, himself, was a member, and also Captain Noble, who, immediately after the adoption of the gun as a field-piece, became his partner." (No. 4,196.) So that Colonel St. George and Captain Wiseman were members of the Committee which recommended, and of the Committee which approved on their own report, the adoption of the Armstrong guns. The direct personal interest which the other two members of the first Committee had in the matter, has been already pointed out.

The reply of the Duke of Somerset to question No. 5,145 appropriately closes the extracts relating to the general conduct towards inventors of the Ordnance Department :—" I do not think that inventors are very fond of the Ordnance Select Committee. They used to come to me, many of them, because they said they did not like the Ordnance Committee."

The foregoing extracts are not a tithe of the evidence proving the protection to Armstrong guns, no matter of what kind or class, and hostility to all other guns, systematically exercised by the War Department officials, from 1854 to 1863. The result, which might be anticipated, and probably was foreseen by Sir W. Armstrong and his supporters, naturally ensued. This result is proved by the evidence of Mr. T. G. Baring, Secretary for War in 1861: —" The Committee will see that at that time (when the heavy Armstrong ordnance was adopted into the service) there was no other gun before the War-office, which could be put at all in competition with the Armstrong gun; indeed, I may say there was no gun at all. *Therefore*, the Armstrong gun was the gun to be manufactured." That is to say, not because it was the best gun, but because no provision had been made by the War Department to test or produce any other gun. All other projectors and manufacturers but Sir W. Armstrong and the Elswick Company, were kept in ignorance of any competition, or withdrew from it in disgust. It was Hobson's choice. At a moment of peril, when war with America was imminent, the Admiralty was forced to accept the Armstrong 110-pounder, which has since been found totally unfit for broadside guns.

The facts proving gross partiality, are too patent to admit of doubt. As to the subordinate officers, and members of Committees, no censure can be cast upon them, for the zeal and efficiency with which they carried out the measures planned in the superior regions of the War-office. In the military *regime*, " to hear is to obey." They saw, plainly enough, that the Armstrong system was in favour in the highest quarters, and was destined to supersede all others. Under the circumstances detailed, competition was a farce. The Elswick Ordnance Company, no doubt planned in 1854, when Mr. Armstrong obtained his first order from the Duke of Newcastle, was looming in the distance. It was the prize sought after. By means, which, perhaps, the future may reveal, vast administrative and official patronage was brought to bear to further the grand scheme of the projector. Complete success in a pecuniary sense crowned his skilful combinations. The facts proved by the evidence exhibit, if not jobbery, official infatuation and favouritism. The same year, 1859, saw the Elswick Company an accomplished fact, all rivals set aside, and Mr. Armstrong, Sir William.

NEW PORTABLE STEAM PUMP.

M. LOUVIE, of Brussels, has invented a double-action pump of great simplicity, which, being at once self-acting and almost devoid of machinery, may prove useful in many situations where fuel is not expensive or facilities for repairs very accessible. It has no pistons, and is put in action by the alternate pressure and condensation of steam; drawing and discharging a continuous stream of water. The absence of mechanism points it out as being peculiarly adapted for feeding steam boilers.

It consists of two sheet-iron cylinders, and a third vessel resembling them, which, serving as a reservoir for compressed air, is surmounted by a tube through which the water is discharged—this tube descends within the air-vessel; secondly, of two suction tubes uniting into one, and two tubes connected with the air-vessel—all four being provided with clack valves; and thirdly, of a small pipe placed between the two first-mentioned cylinders, and communicating alternately with each, in order to condense the steam by a jet of cold water, which, passing from the full cylinder into that containing steam, instantaneously produces a vacuum, and causes the ascent of the water. Between the pump barrels is placed a small receiver, full of cold water, which serves to start the apparatus at first. This is evidently an improved model of Savary's engine, costing very little money, and, doubtless, capable of doing good service in many situations.

A NEW MONSTER RAILWAY BRIDGE.

AMONG the Parliamentary notices this season is one for the construction of a railway bridge across the Forth, to facilitate the communication between the Eastern Lowlands of Scotland and the North, the traffic at present passing either by the route of the Western Lowlands to the North, *i.e.*, *via* the Scottish Central Railway, to Stirling and Perth, or by a railway ferry at Burntisland, which is found expensive, cumbrous, and liable to detention. The point thought of to construct a bridge at first was Queensferry; but the Admiralty object to any structure which would prevent their ships passing to the anchorage above; while the depth of the water is also another reason why the only bridge permissible there should be a railway bridge. But the span of such a bridge would exceed anything hitherto known. Consequently, a point farther up the river had to be selected. The point which the Parliamentary notices state to have been fixed upon is a point about four miles above Queensferry, and is stated to be the point at which the Edinburgh and Glasgow Railway on the south side, and the Dunfermline Railways on the north side of the Frith, run nearest to the respective shores. Locally the point is known, on the south side, as Pardovan, and on the north side as Charleston. It is said that the depth of water, the nature of the soil in the river bed, and the character of the approaches on each side, are favourable to the construction of a bridge at this point of the river, and that a moderate headway only will be required.

This new bridge is proposed to be constructed by an independent company, who will afford running powers and facilities to all the railway companies choosing to make use of it. It is obvious that it must be used by the several lines running to the east coast from Edinburgh, and also, we should apprehend, by the Caledonian. These lines will all be able to reach the bridge by very short extensions.

This bridge, which will be built on about fifty piers, will necessarily be of great length—nearly as long, it is said, as the Victoria Bridge across the St. Lawrence. It will not, however, involve by any means the same cost of construction. The cost of the Frith of Forth Bridge is not estimated to exceed half a million; whilst the Victoria Bridge, which had to be exported, as it were, to Canada, cost nearly a million and a half.

When completed (says the *Daily News*) the Frith of Forth Bridge will be to Scotland what the Britannia Bridge is to Wales—one of the wonders and attractions of the country. Its height, its great length, the character of its construction, and the beauty of the scenery at the points it touches, will present new inducements to tourists. It is anticipated that the work will be completed in less than than three years from the time that Parliament may grant powers for its commencement.

NOVEL SILK MACHINERY.*

LATELY, there have been introduced to the silk trade several novel machines which, though they have not hitherto obtained extensive use in this country, may prove useful aids to silk industry. One is a mode of winding the silk from the cocoon, and spinning it on the same machine. This has been done by Mr. Chadwick and others of Manchester, and beautiful work produced; but the difficulties in a new machine of turning-off a paying quantity of work, joined to the want of commercial facilities for obtaining from abroad an adequate supply of cocoons, has hitherto impeded the success of the experiment. Another is a mode of " sizing " or measuring the thickness of the silk thread, by passing it between two or more rollers nicely adjusted, and so arranged that when a part of different thickness occurs, the rollers move a system of levers which either stop the winding-on bobbin, or else transfer the thread to another bobbin. This operation is also accomplished by taking paper spools exactly alike in weight, and winding upon each of them a definite number of yards of silk, then with a delicate balance assorting them, placing those of like weight in distinct lots, and thus obtaining a number of spools with equal lengths and weights of silk to be put together on the doubling machine; for this matching is essential to the regularity of the twist in the silk spinning, as when threads of unequal diameters are "thrown" together it is very difficult to prevent its being unevenly done, and harder twisted in one place than another, or "corkscrewed," as it is technically called. At present, it is the office of a manager or operative of approved skill to " size " or match by the eye or touch the various bobbins of raw silk, before placing them on the spinning or doubling machines. To meet this purpose, there has also been invented in France a doubling system which, in place of taking several distinct strands or threads of silk, and winding them together as in the doubling machine first described, only deals with one thread of silk, which in an ingenious manner is doubled or rather tripled upon itself into three strands, by means of a traversing carriage like that of a cotton mule, putting at the end of each traverse a loop in the silk, doubling, and, thus, so to speak, matching the silk with itself, with the same view of attaining an improvement in the manufacture of the thread when twisted together. In the silk dye-house, a very useful machine from America has recently been introduced. To the present time, the silk, after being dyed, has been " stringed " or glossed by means of the severe hand labour of men twisting it in the hank with sticks to and fro, so as to rub the strands together, and produce the beautiful lustre so characteristic of the material; this required strong and skilful men, and with every exertion a workman could not finish much per day; but the machine in question entirely dispenses with the great physical exertions of the workman, and enables him to produce a larger amount of polished silk. This operation is performed in a box of cast iron with a steam-tight door, in which the silk can be placed on two rollers, the upper one adjustable to suit the varying lengths of the hanks, and the lower roller is fixed upon the head of a piston rod attached to a piston moving downwards in a steam cylinder; when the silk is placed upon the rollers, the door is shut, and the high-pressure steam is introduced, thoroughly saturating the silk; then by another valve the steam enters the steam cylinder, and the silk, whilst immersed in steam, is strongly stretched by the pressure applied to the piston; during the process, the silk hank is slowly revolved upon the rollers by gearing communica-

* Treatise on Mills and Millwork. By W. Fairbairn, Esq. London: Longman, Green, Longman, Roberts, and Green. 1863.

ting with the outside of the box, so that the shades of colour shall not be varied at those parts of the hank which bend round the rollers, and a few seconds suffice for the completion of several hanks.

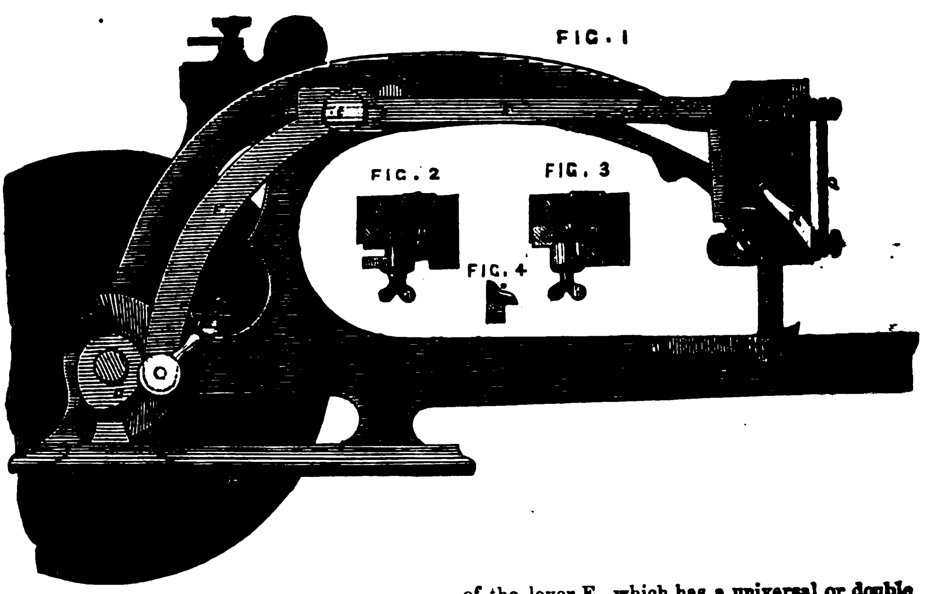
This class of machinery is, with slight modifications, adapted for the manufacture of sewing silks, warp and weft for piece goods, and for crape; but for inferior fabrics in silk the waste or spun silk is used, and this manufacture is very similar to that of flax or fine cotton. The waste silk from the cocoon-winding factories or the raw silk manufactories is combed or heckled, then cut into lengths of from 1¼ to 5 or 6 in., then placed in the opening machines, afterwards sewn up in small bags and boiled, to cleanse it from gum and other impurities, and after drying, is batted or opened with sticks like fine cotton; from this it is passed through breaker and finisher carding engines, drawing and roving frames, and mules constructed with rollers of spaces and adjustments, adequate for fibres of this length, when it is reeled and dyed as the raw silk before described.

M. GIFFARD AND AERIAL NAVIGATION.

M. Giffard, the inventor of the injector, has appeared in the field for invention opened up by aerial navigation. M. l'Abbé Moigno writes as follows on the subject:—"We have had the pleasure of spending some delightful hours recently with M. H. Giffard, and of receiving from him much valuable information which he has permitted us to transmit to the public. He believes that he has solved the problem of navigating the air. When the excitement caused by the success of his injector shall have ceased, and M. Giffard shall have recovered his *sangfroid*, he proposes once more to enter the arena with a cylindrical balloon, steam engine, and surface condenser. Setting out from the Champ de Mars, his aerostat, under perfect control, will make the tour of Paris and return to the Champ de Mars, as a racehorse sets out from the starting-post and returns there. M. Giffard, and those who have connected themselves with his scheme, state with certainty, that the motive power placed in the car will propel the balloon—supposing the weather calm or the breeze very slight—at the rate of thirty miles per hour—the average speed of a railway train. He adds, that the provision of coal and water carried by a balloon of moderate size, will suffice for a voyage of three days and three nights. The motive power will be a srew, but a sensible screw, one with large vanes, attached to the car and driven at a slow speed. Such a statement will surprise many; we may remark, however, that the inventor, since his last ascent, has not ceased to study those questions which are connected with the solution of the problem. He has tested every imaginable fabric, in the search for one sufficiently impermeable to permit him to use pure hydrogen obtained directly from water. He smiles when he sees men resort to heavy, thick, and expensive silks, while a double muslin, with an intervening thickness of black American india rubber, will do admirable service."

He states that he is "able to construct a steam engine whose weight shall bear a very small proportion to that of ordinary engines of equal power. The first machine constructed in the shops of M. Flaud, has already been worked with success at 900 lbs. per square inch; and M. Giffard has learned how to raise even this to as much as 3,000 lbs. on the square inch! This, in itself, is not enough; the quantity of water which can be taken up is necessarily very small, therefore the same water must be used over and over again. The public can see, if they will, in the Rue Jean Goujon, No. 27, a system of pipes, suspended just beneath the roof of a large workshop, which condense the waste steam from a 10-horse engine; every difficulty is thus provided for; and in the course of a very few months, we trust that successful experiments will solve every doubt respecting the success of M. Giffard's enterprise."

SMITH'S SEWING MACHINES.



SMITH'S IMPROVEMENTS IN SEWING MACHINES.

This invention, by G. H. Smith, machinist, of Ipswich, relates to the means of producing the feed motions of certain sewing machines known by the name of double or back action machines, and consists in the combination of a lever working on a universal jointed or double action fulcrum and actuated by a double tappet, on which lever is suspended from or near the end a feeder with a universal joint at the upper part, admitting of its being moved either forwards or backwards across the arm of the machine, or at right angles to such direction of motion, such feeder acting in combination with a double guide capable of being moved and set so as required to form a guide way for the feeder in either of its respective motions, and a bevel formed on the operating end of the working lever, or on the end of a fixed spring, and impelled by the said lever for the purpose of acting on a bevel formed on the feeder in order to produce the required motion of the same, either in the direction of the length of the arm of the machine by the one bevel sliding over the other, or in the direction across the arm by the pressure of one bevelled piece on the other. By means of this combination the feeder is worked through the several motions required for propelling or feeding the article to be sewed either across or up the arm of the machine by the agency of one lever instead of requiring two or more levers as usual, such lever having a fulcrum with a universal or double action joint, and being worked by a double tappet on the driving shaft.

Fig. 1 is an elevation of the machine at the side to which the lever and feeder are applied; fig. 2 is a horizontal section showing the parts of the lever, feeder, and double guide, in their respective positions; and fig. 3 is a similar section showing the same parts arranged so as to produce the motion of the feeder in the direction of the length of the arm. In these several figures the same letters of reference indicate corresponding parts.

A, A, is the ordinary frame or standard of the machine; B is the ordinary arm of the same; C is the driving shaft; D, D*, is a double tappet, whereof the edge of the part D is caused, by the revolution of the shaft C, to act on the lever E, in such a manner as to raise the feeder F, by raising that end of the lever E from which it is suspended, and the face of the part D* of the double tappet is caused to act on the lever E, so as to give the required horizontal motion to the feeder F, springs being applied both to the lever and the feeder for the purpose of returning them to their respective positions after the cams have respectively ceased to operate. G is the fulcrum of the lever E, which has a universal or double action joint (as shown on the drawing by dotted lines) on which the lever oscillates in such a manner as to produce the requisite feed motions. H is the operating end of the lever, which is formed with a bevel I, as shown in figs. 2 and 3, capable of acting on a correspondingly-formed bevel K, on the feeder F, for the purpose of moving the feeder, either in the direction of the length of the arm or in that across, according as the double guide L is in the position shown in fig. 3 or in that shown in fig. 2. The double guide L is turned on a pivot M by means of a thumb screw N, and secured either in the position shown in fig. 2, or in that shown in fig. 3. When it is in the position shown in fig. 2 it presents a stop to the movement of the feeder in the direction of the length of the arm B, but leaves an opening which admits of its movement in the direction across the arm by the pressure of the bevelled part against that of the feeder. And when the double guide is in the position shown in fig. 3 it presents a stop to the movement of the feeder F in the direction across the arm B, but leaves a space for the feeder to be moved towards the left hand in the figure or in the direction of the length of the arm by the action of the bevel I on the bevel K. Hence it will be seen that the required motions of the feeder F may be controlled and regulated by merely setting the double guide in the manner described, thereby obviating the necessity of displacing or changing the feeder when the direction of the feeding is required to be changed. O is the fulcrum or centre of suspension of the feeder; this fulcrum has also a universal or double action joint so as to accommodate the motions of the feeder to the motions of the lever E. Fig. 4 represents detached a horizontal section of the feeder showing the foot or presser at the bottom of the same, which, it will be observed, is formed with two members or claws, whereof one is adapted for feeding in the direction across the arm B, and the other in that of the length of the arm, the needle indicated by the small circle being similarly situated in relation to each of them. The bottom surface of the foot or presser is jagged or serrated in such a manner as to give it the required hold on the cloth or material to be sewed when worked in either direction. P is a vulcanized india-rubber spring for keeping the foot of the lever E in contact with the part D* of the double tappet as required when the bevel is formed on the end of the lever E. Q is another spring of the same kind for bringing down the opposite end of the lever E as required, after it has been raised by the action of the part D of the double tappet on the lever. R is a steel spring for returning to its position the feeder F after it has been acted upon by the lever E.

PAGE'S IMPROVEMENTS IN TAPS OR VALVES.

This invention, patented by Mr. John Page, engineer, Liverpool, comprises various improvements in taps or valves to be made in various materials, and to control the passage of fluids, such as water, gas, or steam.

In one arrangement of tap or valve a conical plug is employed, this plug working as usual in a conical chamber or body; the plug is however hollow, the fluid entering it by a side opening, and being discharged through one end of the plug made to project for that purpose, whilst the handle by which it is turned is fixed upon the other end. If a curved discharge is wanted, the projecting part may be curved round, or it may be cut off close to the body, and a spout be screwed or otherwise fixed upon the body; or the passage or piping may be continued in any convenient way from what may be termed the bottom of the tap body.

An important feature in this improved arrangement consists in the opening by which the fluid enters the hollow plug being carried some distance round the plug, instead of being parallel to its axis as in ordinary cases, the object of this improved arrangement being to permit of the tap being opened very gradually, and to render it in consequence suitable for high pressures.

Another modification, embodying the feature of a hollow plug with the opening round it, is well suited for the purposes of a hydrant. The plug in this case is an inverted hollow cup, into which the water enters from below, whilst the discharge is by a slot round a portion of the side into a curved discharge branch. The spindle of the plug or cup passes upwards through a stuffing-box or plain aperture, and is shaped externally to receive a key or handle for opening it by. Taps or valves of various sizes may be made in this way.

In valves or hydrants in which a disc valve-piece with a conical or spherical rim is made to close against an annular seat, through which the fluid passes when the valve is opened, the details for opening the valve-piece comprise, according to the present invention, firstly, a spindle projecting through an aperture or stuffing-box to receive a key or handle externally to turn it, but constructed not to move longitudinally; secondly, a screw into which the spindle is entered or with which it is otherwise connected so as to turn it and permit of its longitudinal movement; and, thirdly, a nut fixed inside the valve body, and through which the screw works. The valve-piece is attached to or forms part of the screw or screwed piece, and is moved to or from its seat by turning the spindle. The passage leading to and from the valve may be variously arranged, and so that the valve either closes against the pressure or has the pressure tending to keep it closed. Similar actuating details may be used in the case of sluice or sliding valves. In valves of this class the slide or sluice is on closing forced home with its extreme end projecting more or less into a small recess. This recess is very apt to get filled with dirt, so as to prevent the valves being properly closed; by the present invention, however, this inconvenience is prevented by forming a passage in communication with this recess in such a way that when the valve is open the fluid scours freely through the recess, and so removes any sediment.

Fig. 1 in the accompanying drawing is a vertical section of a tap constructed according to this invention. In this arrangement a conical plug 2 is employed, this plug working as usual in a conical chamber in the tap body 1; the plug 2 is however hollow, the fluid entering it by a side opening 3, and being discharged through one end of the plug 2, the smaller end in this example made to project for that purpose, and having a mouth-piece 4 screwed upon it in such a way as to hold the plug in its place in the tap body 1. A handle 5 is formed on, or it may be fixed on or applied to the other end of the plug 2. If a curved discharge is wanted, the projecting part of the plug may be curved, or it may be cut off close to or within the body, and a spout 6 may be screwed or otherwise fixed to the tap body 1; or the passage or piping 6 may be continued in any convenient way from the tap body. A sluice

Fig. 1.

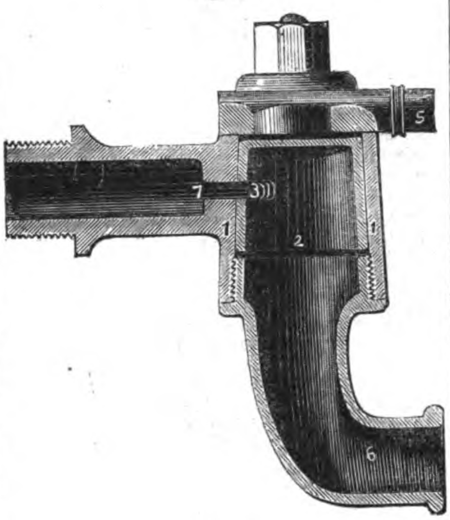
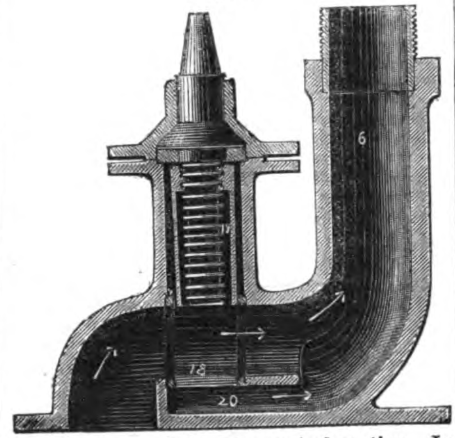


Fig. 2.



valve is shown at fig. 2 in vertical section. In valves of this class the slide or sluice 17 is on closing forced home with its extreme or bottom end projecting more or less into a small recess 18 opposite to the box 19, into which the slide is withdrawn when opened. This recess 18 is very apt to get filled with dirt so as to prevent the valve from being properly closed; by this invention, however, this inconvenience is prevented by forming a passage 20 in communication with this recess in such a way that when the valve is open the fluid scours freely through the recess 18 and passage 20, and so removes any sediment.

FOUNDRIES AND FOUNDRY ECONOMY.

It would well repay the venture of some enterprising capitalist to establish a model foundry in London. Iron-founding is now practised here after a very primitive and uncommercial manner. Not that finer casting can be had than those turned out by London houses, employing the best skilled moulders and the finest Charlton or Woolwich sand; for nowhere in the world can such founders' sand be found as that which may be purchased in the loam-pits within twenty miles of the metropolis. Excellent "work," whether it be that of the founder or mechanician, has long been procurable; for the best makers of our time cannot surpass the workmanship of the last century, so far as quality alone is considered. The great object, in these times, is to produce excellent work at a very moderate cost. This the London founders cannot do. We know from the practice of the Glasgow chair-founders that small castings (nearly one hundred separate pieces to the ton) can be profitably produced at from £4 to £4 10s. per ton, and in this case the whole of the moulding is done by hand. In other words, "moulding machines" are not employed. London houses have, of course, to meet heavier charges, every way, than prevail in the North. Iron is nearly or quite 10s. per ton dearer here than in the north, and so is coke. Wages are heavier also; but the difference, in these three important elements of foundry charges, does not account for the difference in the cost of turning out finished castings. We work, here, at a lower blast pressure, we burn more coke per ton of metal brought down, and in other ways incur greater expense. Many of the northern founders work with a blast of from 20 in. to 24 in. of water, whereas there are many founders here who do not go above 8 in. With small cupolas, say 22 in. in diameter, the higher blast permits of running off 5 tons an hour, while with the milder blast, 1 to 1½ tons only is reckoned fair with the same-sized cupola. In respect of fuel we know London founders who, paying 30s. a ton for coke, melt but 3 lbs. of iron, or, rather, make but 3 lbs. of finished castings per pound of coke, while in better worked establishments 6 lbs. to 8 lbs. of castings to 1 lb. of coke is not unusual. Hard blowing is, we believe, of great consequence in the economical production of casting. In blast furnaces, where the pillar of blast was once 1¾ lb. to 2 lbs. only per square inch, a great advantage, as we know, has been secured by the adoption of more powerful blast engines, working at 6 lbs., 7 lbs., and, in exceptional cases, even up to 10 lbs. per square inch. So in foundries; for a 22 in. cupola a Lloyd's fan, 36 in. in diameter, and making 1,400 to 1,800 revolutions per minute, is found to be much better than the old rule of employing a fan of the same diameter only as the cupola itself, and, working it, as was formerly practised, at a low speed. The construction of cupolas has, of course, much to do with economy of fuel. The old "churn" pattern, larger at the bottom than the top, gives no support to the charges, nor does it permit of the proper diffusion of the blast among the fuel. The Manchester practice, of which Mr. Ireland—a veteran foundry engineer—may be considered the father, is to make the cupola something in shape like a blast furnace, with boshes and a crucible or hearth below. Here, too, the blast is subdivided among ten or a dozen tuyeres, arranged in at least two rows. One of Mr. Ireland's cupolas, of which we have a drawing before us, is 4 ft. in diameter outside; the crucible is 22 in. in diameter; the boshes, enlarging to 33 in., are 22 in. high; and the whole height from the floor is 21 ft. The blast, brought in through two 9 in. pipes, is admitted into two annular cast-iron chambers built into the fire-brick lining, and conducted thence into the interior through a bottom row of three 6 in. tuyeres, and an upper row of eight 2½ in. tuyeres. The large lower tuyeres are about 20 in. below the bottom of the boshes, the upper or 2½ in. tuyeres, being exactly at the bottom of the boshes. All the tuyeres, eleven in number, have sight holes, closed by lids swinging upon pins, and there are valves to shut off the blast from either or all the tuyeres. In some of these cupolas, melting free running iron, 10 lbs. of metal, we believe, are run down per lb. of coke.

It is worth the while of our town founders to attempt the substitution of gas coke at 11s. per ton for the costly article of which Messrs. Straker and Love's, from the Brancepeth pits, is reckoned reasonable at 30s. A ton of gas coke is a ton of carbon nearly, and a ton of the best foundry coke, however free from sulphur, is no more. At one time it was thought to be wholly out of the question to burn "slack" under steam boilers. It went a begging at 4s. or so per ton, until at last some one made the attempt to burn it, after which it rose in price until, at last, it can hardly be bought, in London, under 11s. If it were attempted to burn gas coke in cupolas, smearing it, possibly, with chalk and water to secure a proper flux for the iron, it might result that our town founders would save at least one-

half of their present charges for fuel. The experiment, certainly, is worth making.

The "drop-bottom" is one of the essentials to a good cupola, which deserves to have been long since adopted here, as it is abroad. If a charge "sets," from want of blast, in a cupola, there is nothing to do but to tear down the whole affair, and even under the ordinary circumstances of working, "raking out" after drawing off a charge is a most laborious, and, indeed, severe operation. If, when a charge of iron has been run out, the remaining contents of the cupola could be quickly and quietly dropped into a pit below, the foundrymen, at least, would appreciate the saving of labour and of that slow process of broiling which necessarily attends a quarter hour's exposure to melted iron and hissing lava. The "drop-bottom," we find, is being at last adopted by some of our very best founders, who count largely upon the saving of labour, and the advantage which their workmen are likely to derive from its introduction. It has been said of the "drop-bottom" that the unexpected dropping of a cupola full of melted iron would be attended with great danger, and, furthermore, that the cost of making a new "bottom" at every charging would counterweigh every possible advantage to be derived from its use. As for dropping a charge, it could, at the worst, only fall into a deep pit, and this could only happen through the deliberate action of a workman, for the bottom should swing upon hinges of great strength, and it is usually held by a flat bolt, say 3 in. by 1½ in., passing through two very strong staples. As for making a fresh bottom at every charge, here is nothing of the sort. The cast-iron bottom, say 1½ in. thick, has a raised flange, curb, or cooming upon its upper surface, and within this cooming, 3 in. high or thereabouts, are bedded a quantity of fire-brick to the thickness of 4 in. or more, and these are so secured as to form an integral part of the bottom itself, dropping with it and rising again into their proper place. When the drop-bottom is locked in its place, therefore, preparatory to a fresh charge, there is only a little trimming with fire-clay or road-drift required to make a perfect joint all round; and this operation, we know, occupies an amount of time wholly beneath consideration.

An important opening for business—which the iron-founder should keep in view—is that for the production of malleable cast iron, the use of which is rapidly increasing. To many, the production of malleable cast iron is a profound secret; and we cannot deny that there are processes now practised among the makers of this material which are known only to themselves. Taking up the subject broadly, however, all malleable cast iron is, simply, cast iron partially decarbonized by exposure either to metallic oxides or to other substances having an affinity equal, or nearly so, to that of oxygen for the carbon contained in iron. Samuel Lucas, of Sheffield, was among the first (in 1804) to make malleable cast iron; and the specification of his patent, easily enough accessible, contains useful, and even interesting, particulars as to its production. From a communication, however, just read by M. Brüll before *La Societe des Ingenieurs Civils*, at Paris, it appears that the illustrious Reaumur, as early as 1722, having the curiosity to learn the possible truth of the workmen's tradition of a lost art of producing sharp and durable chisels from cast iron, undertook a series of experiments, which completely demonstrated the probable truth of this tradition, inasmuch as he actually produced iron which was both fusible and malleable. Let us here digress so far as to observe that the other day we picked up an old annealed cast iron wheel skid from among a lot of scrap in a founder's yard, and that, at our request, a smith succeeded, with some difficulty, in breaking off a piece. From this piece, which we still have by us, he also broke a smaller piece, which, after heating to a cherry red, or to the right heat for drawing copper, he drew into a chisel. This took the colours of steel when cooling from a like heat, and was hardened and ground, and we found it chip wrought iron rably well, while it kept an edge which would have answered very well indeed for many kinds of work in wood. Reaumur had but to partially decarbonize any hard and brittle cast iron, and he was certain to obtain, as we did, a very good chisel steel, not perhaps equal to Huntsman's, but still of useful quality. M. Brüll states that Reaumur, after many experiments, adopted a mixture of chalk and bone-lime *(chaux d'os)* with charcoal. The castings of white iron were heated in close crucibles, along with mixtures of this sort, until they were sufficiently decarbonized. As now made, malleable cast iron, although the subject of many improvements and secret processes, is produced by heating the castings slowly to a red heat while confined in closely luted vessels, and covered with hematite ore in layers. The heat has to be slowly raised, twenty-four hours being occupied in bringing on a red heat, while the decarbonizing process goes on, in some cases, for three, four, or five days longer. The metallic iron contained in the oxide employed sometimes melts and adheres to the surfaces of the castings undergoing treatment. The heat is in this case probably too high, and for this, if for no other reason, oxide of zinc is now in great repute as a decarbonizing agent among the American makers of malleable cast iron. It might be worth while to try black oxide of manganese for the same purpose, although we are not certain that this has not been already done. There are many processes for producing malleable cast iron, all alike, or nearly so, in principle, but different in detail. Messrs. McHaffie and Co., of Glasgow, are just now producing a quality which is attracting some attention, and their process, we believe, is a secret one. It would take but a moderate amount of intelligent experimenting, we apprehend, to find out what this secret is, and in the meantime it would be as well for some of our founders to attempt its discovery for themselves. If iron-founders are not, themselves, capable of operating so as to obtain immediately certain results, there is now an abundance of metallurgical talent only waiting their commands.—*Engineer.*

RAILWAY AND WAGGON GREASE.

THE grease or soap used for diminishing friction on the axles of carriages may be divided into two classes—one, ordinarily termed "locomotive grease," has tallow or fixed oils, or a mixture of both, for its basis, diffused through a weak solution of carbonate of soda; while the other, "antifriction" or "waggon" grease, is a soap of lime and rosin-oil, or certain cheaper substitutes mentioned below. This subject is of more importance than might at first sight appear; for while the grease-account of railway companies forms no inconsiderable item of their expenditure, the waste of motive power, and wear and tear of plant entailed by the use of an unsuitable grease, is enormous. The difficulties experienced from this cause have compelled the leading companies to manufacture their own grease, cost being a secondary consideration to uniformity of quality.

Locomotive Grease.

This is the only article suited for high velocities; it is invariably used for passenger carriages, and latterly for goods and mineral waggons when these are provided with axle-boxes. As ordinarily prepared, it is of a yellow colour, and of various degrees of consistence. In its preparation some makers use palm-oil alone, while others employ tallow also, the extra cost of the latter being more than compensated by a reduction of the *total* quantity of fatty matter employed, since a grease containing 35 per cent. of the mixed fats will go as far as another with 42 per cent. or 45 per cent. of oil alone. The grease richest in material is not necessarily the best or most enduring lubricant, the characteristics of which ought to be:—

1. A suitable consistency;
2. Good lasting power, attended with but little increase of temperature, even at the highest speeds; and,
3. The smallest possible residue left in the axle-boxes.

A grease which is too firm will remain comparatively solid in the box, and allow the axle to become hot; while, on the other hand, one too thin becomes exhausted by a few miles' running.

A few years ago, a series of trials was made upon two lines of railway, the grease under experiment being placed in locked boxes, and the number of miles travelled before replenishing, carefully noted; the minimum was 46, and the maximum within a few miles of 1,200. In the former case, the grease contained 30 per cent. of palm oil alone, and in the latter 35 per cent. of tallow and oil; while a grease containing 46 per cent. of material (almost entirely tallow) ran about 800 miles, being too firm, and deficient in cooling power. That which gave the best results became, after a few revolutions, gradually softened, from the axle upwards, to the consistence of very thick cream, and by continued upward and downward currents, maintained a comparatively low temperature until exhausted.

It is desirable that as little residue as possible should be left in the boxes; for which purpose the smallest available quantity of alkaline carbonate should be used; 1·10 per cent. to 1·20 per cent. actual soda, gives the best practical results; a smaller proportion fails to ensure consistency and durability. The soda is used in the form of crystals.

The Process of Manufacture is exceedingly simple; the fats are melted in a boiler and brought up to 180 degs. to 190 degs Fahr.; the water and soda-crystals are heated in another vessel to 200 degs. Fahr., and both run into a wooden tub, with constant stirring, which is continued at intervals until the mixture is cold. Slow cooling ensures a firm article, and large batches, which retain their heat for a considerable time, are therefore preferable. Care is taken, for obvious reasons, to avoid the introduction of sand or gritty matter. The proportions of materials vary in different establishments, and in the same establishments at different seasons of the year; the grease for July use being too firm for December, and *vice versa*; 25 per cent. is the lowest quantity of fat that can be safely used in the coldest weather, while 35 per cent. is amply sufficient for our warmest summer use; the following proportions have been used with excellent results:—

	Winter.			Summer.		
	cwt.	qr.	lbs.	cwt.	qr.	lbs.
Tallow...........	3	3	0	4	2	0
Palm oil	2	2	0	2	2	0
Sperm oil	0	1	7	0	0	27
Soda crystals ...	1	0	14	1	0	8
Water	12	3	12	12	0	26

These proportions produced one ton of grease (allowing 2½ per cent. for loss)—that marked "summer" ran 1,200 miles; the sperm oil, although small in quantity, has an excellent effect; but some makers, for economy, use rosin-oil instead, although the result is questionable.

From the foregoing remarks, it will be seen that a simple analysis of a fatty grease, although indicating cost of production, affords little or no test of its practical value, running power being the true and only criterion.

Antifriction, or Waggon Grease.

The greatly increased price of rosin, occasioned by the American blockade, has led to a diminished use of this article. It is well suited for low speeds; it was extensively employed for goods and mineral traffic when its cost was less than one-half that of locomotive grease; but now that the value is considerably greater than the latter, its use is confined to waggons having no axle-boxes.

This grease is of two kinds, with or without water; both should be free from lumps or gritty particles, smooth, and of such consistency as to be easily spread on the bare axle; the former should not part with its water when moderately agitated. The materials used are rosin-oil (obtained by distillation) and caustic lime in a very fine state of division: this latter is obtained by the well-known process of running milk of lime through a series of overflow tubes, in the last of which, receiving the finest particles, it is allowed to subside, and the precipitate drained on canvas

to a pulpy condition. If grease free from water is wanted, this pulp of lime is agitated with rosin spirit, which, seizing the lime, expels the water; the latter, floating on the surface, is run off, and a further quantity of spirit is added until the mass is reduced to a cream, when it is ready for use. If a watery grease is wanted, the finely-divided lime, without spirit, is simply used in a milky condition.

The Process of Manufacture consists in adding to any convenient quantity of rosin-oil, without the application of heat, either of the above preparations of lime, until the mixture begins to thicken, avoiding an excess, lest the grease should be too hard. The quantity of lime varies with the quantity of oil used; in the case of the finer grease, there is no gain in adding an excess, as the spirit is the most costly ingredient; a cream is therefore used; while for the lower qualities, the watery milk of lime is made very thin, so that, in some cases, as much as one-fourth of the bulk of oil is added. The materials are well stirred together for about fifteen minutes in a tight box or a barrel in which a shaft furnished with blades or stirrers is made to revolve. The grease thus formed is run into barrels or receptacles before it solidifies or "sets."

Any written directions for the preparation of this grease must necessarily be general rather than specific, as so much depends upon daily practical experience; a manufacturer when in doubt about a new oil or lime mixture, generally experiments upon a small quantity first, and is guided thereby in his operations on the large scale.

The present high price of rosin has compelled manufacturers to employ several cheaper substitutes for it, such as paraffin residues mixed with coal-tar, residues from candle-making, from cotton-seed oil, fish oils or footes, pitch oil, the heavier parts of the American petroleum, &c.; all these produce grease of a certain quality, but none with the lubricating power of rosin grease. —*Chemical Technologist*.

Legal Intelligence.

VICE-CHANCELLOR'S COURT.

Pepper and Another v. Myers and Another. —This was an application for an injunction to restrain the defendant from performing the celebrated "Ghost" illusion. The plaintiffs were Professor Pepper and Joseph Heath, of Liverpool, and the circumstances of the case were as follows (according to the plaintiffs' version):—Mr. Pepper, with one Henry Dircks, were the first inventors of "improvements in apparatus to be used in the exhibition of dramatic and other like performances," and in August, 1863, letters patent were granted, giving them exclusive right of using their invention for 14 years. The method by which the illusion is produced is as follows:—The nature and object of the invention is, by a peculiar arrangement of apparatus, to associate on the same stage a phantom or phantoms with a living actor or actors, so that the two may act in concert. The arrangement of the theatre requires, in addition to the ordinary stage, a second one at a lower level, hidden from the audience as far as direct vision is concerned; the hidden stage is to be strongly illuminated by artificial light, and capable of being darkened instantaneously, whilst the ordinary stage and the theatre remain illuminated by ordinary lighting. A large glass screen is placed on the ordinary stage and in front of the hidden one. The spectators will thus not observe the glass screen, but will see the actors on the ordinary stage through it as if they were not there; nevertheless, the glass will serve to reflect to them an image of the actors on the hidden stage when these are illuminated, but this image is made immediately to disappear by darkening the hidden stage. The glass screen is set in a frame, so that it can be readily moved to the place required, and it is to be set at an inclination to enable the spectators, whether in the pit, boxes, or gallery, to see the reflected image. The glass is adjustable, and it is readily adjusted to the proper inclination by having a person in the pit and another in the gallery to inform the party who is adjusting the glass when they see the image correctly. The hidden stage is capable of being closed at the top by trap-doors. When the trap-doors are closed actors on the ordinary or visible stage can pass freely to and fro above the lower or hidden stage. The ordinary stage and trap-doors are covered with green baize, or other dark material, so that when the trap-doors are opened, the audience, even those in the gallery, will not readily be able to perceive the opening. The actors, or objects corresponding with the phantom images which it is desired to represent to the audience, are strongly illuminated by the lime-light, or the electric-light, or other powerful illuminating means may be employed. This light must accompany the actor in any movement he has to make. The hidden stage and the lanterns may be mounted on a carriage on rails, so that when it is necessary for the phantom actor or object on the lower stage to be moved, the lanterns may be caused to move also, or the lanterns may remain stationary whilst the actor moves, provided the whole space through which he moves is sufficiently illuminated. The lanterns are to be provided with means for instantaneously extinguishing or making the light, and for reproducing it, so that the phantom may be made to disappear and reappear at pleasure, whilst the audience and the stage will be more or less lighted in the ordinary manner, according to the effects desired to be obtained. For this purpose, a board is employed which is capable of being raised into a position so as entirely to cut off the light from the hidden stage when desired, or an ordinary opaque shade attached to the lantern may be used for the purpose, or when using the lime-light the desired effects are caused by gradually or instantaneously (as the case may require) cutting off the supply of gases, and the phantom image may by any of these means be caused gradually or instantaneously to fade away. When the trap-doors over the hidden stage are open, the part thereof assists in hiding the lanterns and the opening from the audience. The part acts to screen the lanterns from the audience, and also to ensure that any actor or object on the hidden stage shall not accidentally appear above the level of the visible stage. The phantom actor, when standing on the stage, leans against the screen, which is inclined so as to be parallel with the glass screen, and is covered with black velvet or other dark material, as is also the stage, in order that no image of either the screen or the stage may be seen in the reflection. The glass screen is a large inclined sheet of plate-glass on the ordinary stage, of sufficient size to reflect the full length of the actors or objects on the hidden stage to the audience in the pit, boxes, and galleries of the theatre. The hidden stage is between the glass and the audience. The glass is mounted in a swing frame so that it may be adjusted to the angle required by screws, or ropes and pulleys, or otherwise. The glass is to be set at such an inclination as to bring the reflected image to the level of the visible stage. This will enable the spectators, whether in the pit, boxes, or gallery, to see the reflected image without any obstruction to the view above the footlights, and it will be visible from all parts of the house except those extreme positions which cannot command a view through the glass of that part of the stage where the image is reflected. The glass being in a swing frame the proper angle of inclination is ascertained experimentally by having persons in the different parts of the house to say when the image is shown to them correctly. The scenery is so disposed as to conceal the frame of the glass, and we prefer that the glass should be able to descend into an opening or box beneath the stage, in which case we counterbalance the glass and frame so that they may easily be raised into the position desired by means of a rope, by which, aided by the bolts, the glass is supported in the required position. In this case the glass may either be adjusted when screened from the audience, and remain in position during the scenes, or (the proper angle of inclination having been previously ascertained by experiment) the glass may be raised on to the ordinary or visible stage and placed in position whilst the scene is before the eyes of the audience, under a subdued light, without the movement being observed, for which latter purpose the top bar of the frame of the glass should be made very light, or be omitted altogether. This arrangement admits of an actor on the visible stage passing across the space which the glass is to occupy, and this he can do just before the appearance of the phantom; and then immediately the glass is run up, the trap-doors are opened, the actor or image on the hidden stage is illuminated, and the phantom appears. This arrangement will render it less likely that the audience should imagine that there is anything interposed between them and the actors, than if the glass plate remained permanently in position during the scene. The hidden or lower stage may be provided with a trunk or well-hole, up which an actor can rise; he will then appear as a spectre rising out of the visible stage. The lanterns may be provided with coloured glasses in order to heighten the effect. As the actors on the visible stage do not themselves see the spectral images, marks should be placed on the stage, or other indications made, in order that they may know the position which the spectres appearing to the audience are to occupy. In order to appear upright upon the visible stage, the actor or object on the hidden stage should be inclined so as to be as nearly as practicable parallel with the surface of the glass. In effecting this, assistance is afforded by the screen of the hidden stage. Several sheets of glass may be employed at the same time, if one is not of sufficient width to cover the different parts of the stage at which it is desired that the spectre should appear, the interval or junction being concealed by the introduction of a tree or column, or some other piece of scenery.—The injunction was granted.

The case of Spencer v. Jack was heard before the Lord Chancellor on Friday, at Lincoln's-inn. This was an appeal from an order of the Master of the Rolls. The plaintiff was an engineer at Newcastle, and in July, 1860, he took out a patent for an improved method in condensing steam for working steam engines on board ships. It appeared from the specification that the plaintiff claimed as his invention a new combination of well-known matters—namely, surface and jet condensers of steam, which produced new and valuable results. The bill was filed to restrain an alleged infringement of the patent of the defendant's engineers at Liverpool, and, upon the application to the Master of the Rolls for an injunction, his Honour directed issues at law to try whether the patent of the plaintiff was a new and useful invention, whether it had been sufficiently described in the specification, and whether there had been any infringement of it by the defendants. The jury found in favour of the plaintiff on all the issues, and an application for a new trial was made to the Master of the Rolls on the following grounds:—First, that there had been a misdirection of the Lord Chief Justice of the Common Pleas; second, that the verdict was against the evidence; third, that there had been a miscarriage; and fourth, that the defendant had been taken by surprise. The Master of the Rolls granted a new trial, and, upon appeal from that order to the Lords Justices, their Lordships suggested that the matter should be brought before the Lord Chancellor, which was accordingly done.

Mr. Baggallay and Mr. Rigby, with Mr. Streeton and Mr. Webster (of the Common Law Bar), were for the plaintiff, appealing; Mr. Bovill (of the Common Law Bar), Mr. Selwyn, and Mr. Druce, for the respondents.

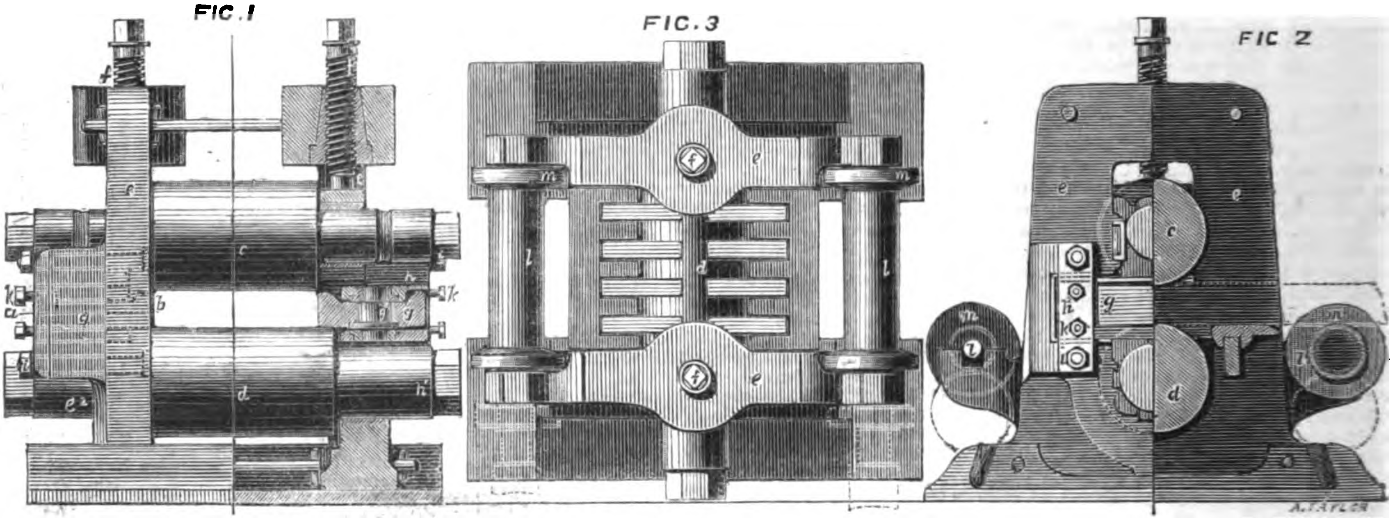
The case was resumed on the 25th.

The Lord Chancellor, in delivering judgment, said he was of opinion that the improvement of the plaintiff was the subject-matter of a patent, and, therefore, that his claim to the patent in question was well founded. With respect, however, to the alleged infringement of it by the defendants, he was unable, from the plaintiff's own specification, to find that there had been any violation of it. The bill must be dismissed without costs, and, as a consequence, the order of the Master of the Rolls must be reversed.

LAUNCH OF A FRENCH FRIGATE.

A colossal iron-coated steam frigate, called the "Numancia," was launched on Thursday last at La Seyne, near Toulon. This leviathan is an iron frigate completely plated over a teak sheathing, and carries 40 guns of the largest calibre in a covered battery, besides some pieces *en barbette* on her upper deck. She is to be rigged as a sailing frigate, and her masts, of a single piece, were brought from the forests of California. Her engines are nominally of 1,000-horse power, but the power may be increased to 4,000-horses. Her coal-bunkers contain 1,000 tons, and her crew will consist of 700 men. Her length on the deck is 288 ft her breadth 52 ft., her draught of water She is supposed to be the largest iron-coated f afloat. Her iron plates are 13 centimetre and weigh 1,300,000 kilogrammes. Her has been tried against the heaviest shot, supposed to be bullet proof. Notwithstan great weight, which exceeds 7,500 tons, pected that this frigate will possess extr speed and great facility of manœuvring, i quence of the immense power of her scr as from her admirable lines. The "Nu was only sixteen months on the stocks.

HARRIS, BUTLER, AND FRASER'S IMPROVEMENTS IN ROLLING ARMOUR PLATES.



HARRIS, BUTLER, AND FRASER'S IMPROVEMENTS IN MACHINERY FOR ROLLING ARMOUR PLATES.

Letters Patent have been recently granted to Messrs. Harris, Butler, and Fraser, iron manufacturers, for improvements in rolling armour plates. These improvements consist in constructing and arranging rolls in such a manner that lateral pressure is applied to plates and bars of iron during the rolling process, and the plates or bars are fed to and conducted from the rolls in a simple and expeditious manner. The patentees make the upper roll of the pair of rolls somewhat shorter than the lower roll, so that the lower roll projects at either end beyond the ends of the upper roll. A recess is made in each of the standards carrying the rolls, these recesses being at about the level of the acting surfaces of the rolls. In each of the recesses a rotating circular collar is placed, the collars rotating on vertical axes. The lower face of each collar rests on the cylindrical surface of the lower roll, and the cylindrical surfaces of the collars bear against the ends of the upper roll. When a plate of iron is passed through the rolls, the edge of the plate is prevented from spreading laterally by the rotating collars, and the edges of the plate are subjected to the same pressure, or nearly the same pressure, as the other parts. The upper roll can be raised or lowered without interfering with the rotating collars and lower roll. To roll plates or bars of any required width, it is only necessary to employ an upper roll having a length equal to the width of the plates to be rolled, the rotating collars being adjusted so as to bear against the ends of the upper roll. The lower roll being always longer than the upper roll, does not require to be changed on changing the upper roll. The rotating collars are adjusted by means of screws acting on their bearings in the recesses in the standards. The plate or bar is guided to and from the rolls by means of rotary guide rolls provided with sliding flanges, so as to accommodate plates or bars of different widths.

Fig. 1 represents, partly in front elevation and partly in vertical section, rolling machinery constructed according to this invention for rolling armour plates, bridge plates, boat plates, and other plates and bars of iron; fig. 2 represents the same, partly in end elevation and partly in transverse section; and fig. 3 is a plan of the same with the top roll removed. *c*, *d*, are the pair of rolls working in bearings in the standards *e*, *e*, the bearings of the upper roll being acted upon by the screws *f*, to adjust the distance between the rolls in the ordinary manner. The upper roll is shorter than the lower one, the lower roll projecting on either side the upper roll, as best seen in the sectional portion of fig. 1. On the outer sides of the standards, and near the level of the acting surfaces of the rolls, are projecting boxes e^2, in which boxes recesses are made, extending through the standards. In these recesses are the rotating collars *g*, and their gearing. The collars turn upon axes g^2, the bearings of the axes being carried by the frame *h*, and the frame *h* and collars *g* are adjusted in the following manner:—On either side, and in front of the recesses in the boxes e^2 and standards *e* vertical bars h^2 are fixed, the said bars being secured to the standards by the screw pins and nuts *i*. In the bars set screws work, the ends of which set screws bear against the frame carrying the rotating collars, and keep the said rotating collars to their bearing against the ends of the upper roll. The lower face of each of the rotating collars rests on the cylindrical surface of the lower roll, and the cylindrical surfaces of the said collars bear against the ends of the upper roll. By means of the rotating circular collars, the edges of the plate or bar being rolled are prevented from spreading laterally. Great density and uniformity and excellence of quality in the rolled plate or bar thereby results, and a rolled and skinned edge obtained, which is very desirable for rivetting purposes. When a plate or bar is required to be rolled of a width greater or less than the width of the upper roll, it is only necessary to change it for one having a length equal to the width of the plate or bar to be rolled. The lower roll being always longer than the upper roll, does not require to be changed on changing the upper roll. On changing the upper roll *c* the rotating collars *g* are adjusted against the ends of the newly-introduced upper roll by means of the set screws *k*, *k*. The upper roll can be raised or lowered in the standards by means of the screws *f* without interfering with the rotating collars and lower roll. By the use of guide rolls *l*, *l*, the plate or bar is carried into and from the rolls without the aid of manual labour.

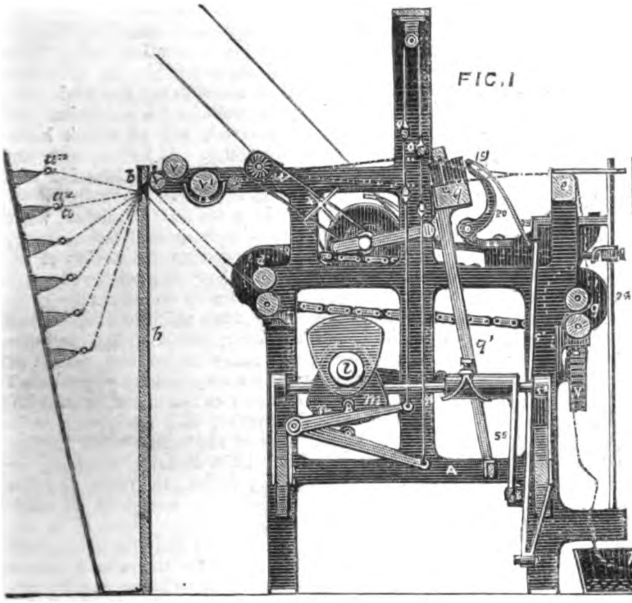
NARROW GAUGE LOCOMOTIVE.

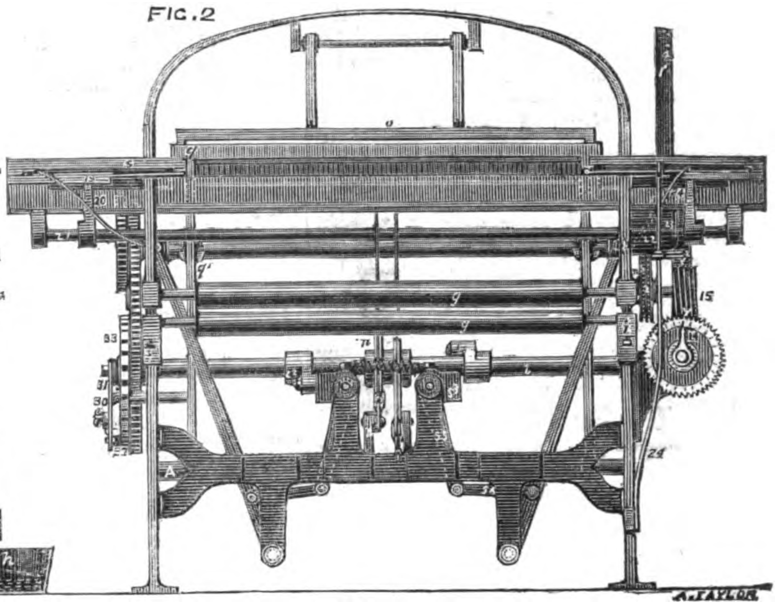
We have, on more than one occasion, pointed out the feasibility of substituting the locomotive for horse-power on almost any existing line, worthy of the term railway, to be found in the mining districts—as in example, the following bear a great deal of interest:—In 1836 a railway, 13½ miles in length, was opened between the slate quarries of Festiniog and the shipping port of Port Madoc, which gradually led to an increase of the shipment of slates from 12,000 tons to 64,000 tons per annum. This railway is on a guage of only 2 ft., and was constructed at a cost of £2,000 per mile. The whole line is a descending one, with several heavy gradients and sharp curves, and was for many years worked at a heavy expense by horse-power—the loaded slate waggons descending by their own weight, and carrying down with them, in boxes made specially for the purpose, the horses which were to bring up the empty trucks. But the use of horse-power came to be felt as an impediment to the further development of the traffic; and accordingly several engineers of eminence, and among others the late Robert Stephenson, were from time to time consulted as to the possibility of employing locomotive power. The invariable answer, however, was that it was impossible to construct a locomotive engine with sufficient power to work such a line with safety and efficiency. The project, nevertheless, was never altogether abandoned, and it has at last been successfully carried out by a young engineer, Mr. Charles Mendes Holland, to whom the dilemma of the company was fortunately made known. The plans furnished by this young gentleman, who is scarcely twenty-one years of age, and has just completed his apprenticeship, were submitted by the directors to qualified persons, and having been by them pronounced feasible, were placed in the hands of Messrs. England and Co., of London, for realization. As already stated, the result has been most successful. At the trial trip, the train accomplished the distance up hill from the port to the quarries in little more than an hour, and the railway has since been in operation as a locomotive line. About three miles from the quarries a small-bore tunnel, three-quarters of a-mile in length is felt to be somewhat disagreeable by passengers, but forms no impediment to the mineral traffic. The special character of the engine lies, we believe, in throwing the weight as low as possible. At the dinner which celebrated the running of the first engine, the impossibility of working any gauge by steam-power, was spoken of by Mr. England as an exploded fallacy. At all events, it might be well worth the while of mineral proprietors, and of the inhabitants of remote Highland districts, to satisfy themselves whether their wants could not be economically met by railways and locomotives after the model of those of Port Madoc.

RESERVOIR PAINTING-BRUSH.

Messrs. Crowden and Garrod have recently patented a painting-brush, the advantages of which, in comparison with the usual kind, is that it is made of first-class bristles selected for the purpose; its shape is nearly flat, and set in thin copper binding, and firmly cemented; it uses evenly, and in one way; and is made to deliver the colour with regularity on the work. The most remarkable feature of the invention is, that the centre of the brush forms a small chamber for the paint, which is worked up to the flag or top of the brush by the arrangement of the bristles, which are so placed to effect this purpose, that, while the brush is in use, it is working the colour to the surface and never becoming clogged. In flatting and stippling, so great an advantage of laying the colour with smoothness, will and must be appreciated by every decorator.

BARLOW'S LOOMS FOR WEAVING.



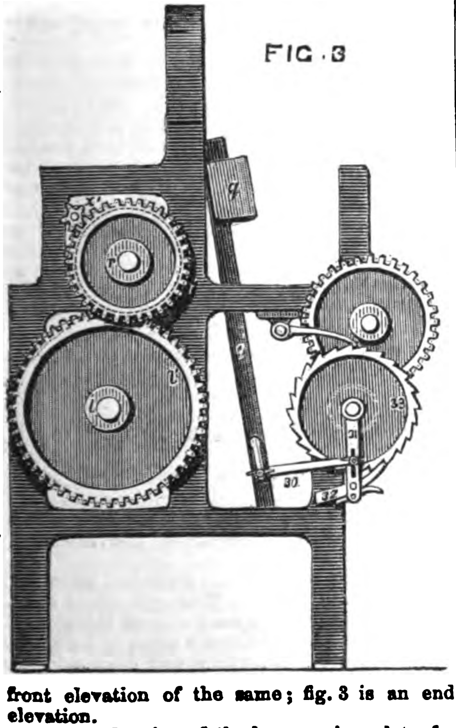


The workman using one of these brushes, will be enabled to cover one-half more space, use less colour, and produce a better result on the work in the same amount of time.

BARLOW'S IMPROVEMENTS IN LOOMS FOR WEAVING.

THE nature of this invention, patented by Mr. H. B. Barlow, Manchester, consists in supporting the bobbins containing the warp yarns or threads by a plate connected to or forming part of the loom, and in guiding the said warp threads direct to the loom, whereby facility is afforded in piecing up a broken end; and also in sizing and dressing the warp before it passes through the healds; and in an improved arrangement of parts for giving off or delivering the warps and for taking up the woven fabric.

Fig. 1 is a sectional elevation of a loom constructed according to this invention; fig. 2 is a



front elevation of the same; fig. 3 is an end elevation.

A is the framing of the loom; *a* is a plate for supporting the bobbins containing the yarn or thread for the warp; the plate *a* is in a slanting position, and the bobbins are placed in regular rows. Each warp thread passes through a hook a^1, fixed in the rods a^*, supported by the studs a^2; as each hook is in line with a bobbin it is evident the bobbins will be unwound regularly. The warp threads pass through the plate *b*, supported by the upright b^1; the plate *b* may have the requsite number of holes for the warp threads, or a rack or a comb may be used; the threads are thus kept separate, and if one breaks it can easily be pieced up without loss of time; whereas in ordinary looms, when a warp thread breaks, the loom has to be stopped to repair it. From the plate *b* the warp threads pass between the unwinding rollers *d*, *d*, which are covered with india rubber, leather, felt, or other suitable substance to give the requsite friction, or they may be grooved or fluted and covered with cloth. The warp passes under the lower roller *d*, and then between the rollers *d*, *d*, from whence it is taken to the sizing and dressing apparatus, consisting of the guide rollers *v*, *v*, the sizing roller v^1, which revolves in the size trough 12, and the two roller brushes *w*, *w*; these brushes remove the excess of size from the warp threads, and the fan *x* dries them before they enter the healds *o*, *o*. The fan is driven by the pinion x_1, see fig. 3. From the healds the warp passes through the reed of the lay, and thence to the breast beam *e*, in the usual manner; the woven fabric is taken up by the rollers *g*, *g*, and deposited in a receptacle *h*. The taking-up rollers *g* are similar to the unwinding rollers *d*; the upper roller of each pair revolves in stationary bearings, and they are turned round simultaneously by the chain 2 passing over the chain pulleys 1, 1, or by toothed wheels if preferred. Each chain pulley is connected to its roller by a set screw m^3, which can be slackened when required to change the position of the roller for tightening the warp. The lower rollers revolve in bearings *i*, fixed to the framing A; the set screws 3, in the bearings *i*, are to press the rollers together. As the fabric is woven and at each stroke of the batten the taking-up rollers are moved by the link 30, see fig. 3, connected at one end to the lay sword and at the other to the suspended lever 31, to which is jointed a catch, taking into the teeth of a ratchet wheel; the fabric is thus taken up as fast as it is woven by the rollers *g*, *g*, and the warp is delivered at the same speed by the rollers *d*. The tappet shaft *l* transmits motion by the tappets *m* to the treadles *n* and healds *o*, which are made in the usual manner. The lay *q* is connected to the lay swords q^1, which are worked by cranks or eccentrics on the shaft *r*. The shafts *l* and *r* are connected by the wheels l^1 and r^1, and the latter is driven by strap and pulleys as usual. The picking motion consists of the picking sticks s^*, actuated by the levers s^2, on the tappet shaft *l*. The bowls on the levers s^2 act on the wipers *ss*, fixed to the vibrating shafts s_1; to each wiper is cast a lever s^5, connected by the links s^6 to the picking sticks. The shuttle, in passing from one shuttle box *s* to the other, acts on a stud 18, against which press the springs 19, acting on the bent arms 20, fixed to the stop rod 21, connected as usual to the batten. The stop rod has the usual stop finger for acting on the slide or frog and spring starting lever, when the shuttle fails to box. The length of fabric woven is measured and indicated by a worm on the axle of the top roller *g* gearing into the wheel *y*, which is furnished with a dial 14. The circumference of the roller is fixed to one-fourth part of a yard or other determined length. By means of these improvements the ordinary operations of winding and warping are dispensed with, the warp threads passing directly from the bobbins to the loom at a uniform tension, thus ensuring great regularity in the work produced.

MANCHESTER BOILER ASSOCIATION.

AT the last monthly meeting of the Executive Committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, November 24th, 1863—the President, William Fairbairn, Esq., C.E., F.R.S., in the chair—Mr. L. E. Fletcher, chief engineer, presented his Monthly Report, of which the following is an abstract:—

"During the past month there have been examined 238 engines and 381 boilers. Of the latter, 17 have been examined specially, 9 internally, 55 thoroughly, and 300 externally, in addition to which 1 of these boilers has been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture, 10 (1 dangerous); corrosion, 25 (5 dangerous); safety valves out of order, 1; water gauges ditto, 30 (3 dangerous); pressure gauges ditto, 5; feed apparatus ditto, 2; blow-out apparatus ditto, 15 (1 dangerous); fusible plugs ditto, 3; furnaces out of shape, 12 (3 dangerous); over-pressure, 3 (1 dangerous). Total, 106 (14 dangerous). Boilers without glass water gauges, 3; without pressure gauges, 45; without blow-out apparatus, 48; without back pressure valves, 72.

"An illustration has lately been met with of the importance of removing portions of mid-feather walls, in order to give an opportunity of examining the plates. On this being done at

the instance of this Association, in the case of a boiler lately put under its care, the bottom, although presumed by its owner and engineer to be perfectly sound, was found to be nearly eaten through by corrosion, and on the very point of rupture, as in the case of No. 39 Explosion, the details of which are given below.

"Instances continue to be met with of serious corrosion, arising from the leakage of bolted joints concealed under brickwork. It cannot be too often repeated that all connections to boilers should be made by means of fitting blocks rivetted to the shell, excepting only the attachments to the front end plate, where they are not absolutely necessary, since the plate being flat the joints are more easily made, while at the same time, from their position, leakage, should it occur, is at once apparent. The front end plate should be left completely open, and not, as is too frequently the case, covered in with a wall of brickwork, since leakage—so prone to occur in the neighbourhood of the furnace mouths—is found to go on behind the brickwork undetected. A case of this sort has just been met with, where a plate was completely eaten through before the corrosion was known.

"EXPLOSIONS.

"No. 31 Explosion occurred at a distance of nearly three hundred miles, and as full details could not then be obtained, the fact of its occurrence was merely entered at the time in the tabular statement. The boiler was not under the inspection of this Association, and it has since been ascertained that it was of plain Cornish construction, having a single flue parallel throughout; its length being 25 ft. 3 in., its diameter in the shell 5 ft. 7 in., and in the flue 3 ft. 5 in., while the thickness of the plates was three-eighths of an inch, and the pressure to which the safety-valves were loaded, 40 lbs. Such a flue, on account of its large diameter, was unsafe from the day on which the boiler was made, though it might easily have been made secure by adopting any of the well-known plans of strengthening flues, among which may be mentioned, hoops, whether of T-iron, angle-iron, or bridge-rail section, as well as flanged seams.

"Six explosions have occurred during the past month, resulting in the death of eleven persons, and serious injury to eighteen others. Not one of the boilers in question was under the inspection of this Association. One of these exploded boilers, No. 39, has been personally examined, while this was prevented in other cases by distance, some of the explosions occurring upwards of two hundred miles from Manchester. It is expected, however, that detailed particulars of all of them will be obtained, while I am already indebted for a minute report on Explosion No. 38, to the kindness of an engineer residing in its locality, and who made an examination shortly after the occurrence.

"No. 38 Explosion, from which one man was killed, occurred to a boiler not under the inspection of this Association, and which was in use at an ironworks.

"The boiler was of plain cylindrical egg-ended shape, externally-fired, and connected by its steam-pipe to two others of different construction; all three collectively working an engine and forge hammer in the rolling mill. The ordinary working pressure of the boiler was 40 lbs., its length 35 ft., and its diameter 6 ft. 5 in., while the plates were of the most unusual and unnecessary thickness, of from nine-sixteenths to five-eighths of an inch.

"It is more difficult to make good work in a boiler with such thick plates, and it is reported that the joints in the present instance were imperfectly closed—that there had been unfair use of the drift, than which few things are more prejudicial to the strength of the boiler—that but few of the rivets were properly laid up, while, in addition, the overlap of the plates at the seams of rivets was unusually wide, and, in short, that the work was altogether most clumsy and inferior. Added to this, the boiler had been repaired over the fire more than once, with plates one-eigth of an inch thinner than the rest, while ...udinal seams of rivets, six feet long, were allowed to fall within the furnace, their original length having been increased by the repairs.

"The boiler had been leaking at the seams in the furnace for three weeks previous to the explosion; and in order to stop this the fireman had been in the habit of putting a bucket-full of sharps as well as a bucket-full of horse manure into the boiler once a week.

"The state of the boiler after the explosion afforded no indications either of overheating from shortness of water or of corrosive action, while there appeared to have been little or no incrustation; but it was found that the shell had rent at one of the longtitudinal seams over the fire, just where the thick old plates had been patched with the comparatively thin new ones. The rent extended throughout the whole length of the seam, and then ran into the transverse ones which crossed it at both ends, completely severing from the remainder of the shell the dome or egg-end. The latter was blown to a considerable distance, while the former, though lifted off its seat, was only thrown a few feet from it.

"The cause of the explosion was made a subject of scientific investigation at the order of the coroner, and the view given in the report thereon by the engineer engaged, may be briefly stated as follows:—

"The explosion was considered to be due to excessive pressure of steam, a pressure greater than that at which the boiler was ordinarily worked, and which it was thought might have arisen in the following way:—The explosion occurred shortly before four o'clock in the afternoon, the boiler having been cleaned out the same morning, while the other two to which it was connected were working alongside meantime. In order to clean this boiler out while the others connected to it had their steam up, it was necessary that the junction valve should be closed, and if this valve had not been re-opened, as it ought to have been, as soon as the steam was up—then in the event of the only safety valve with which this boiler was fitted, either sticking fast in its seat, or being tampered with—the steam would be bottled up, and the pressure continue to rise, without giving any sign until actual explosion resulted, since there was no steam guage upon the boiler.

"One or the other of these two conditions it was concluded had occurred—viz., either that the safety-valve had stuck fast in its seat, or had been intentionally tampered with, at the same time that the boiler was isolated from the other two by the junction valve being shut down.

"The supposition of the junction valve having been left closed was, it was thought, strengthened by the fact that the steam had been so low a few minutes previous to the explosion, that both engines had to be stopped, so that had the boiler in question been then in connection with the others, it was argued that the rupture must have taken place when the pressure was lower than usual, which was not thought likely. That the safety-valve had stuck fast in its seat, was considered most improbable, while the supposition of its having been intentionally tampered with derives support from the reckless character of the fireman, who, shortly after the explosion had occurred, was known, while tending the boiler alongside the exploded one, to have gagged his alarm whistle on it signalling shortness of water; in consequence of which a number of workmen engaged near the boiler deserted their post, stating that they considered their lives in danger.

"The jury dissented from these views, and brought in a verdict of accidental death, adding —'That in their opinion the boiler did not explode from excess of steam, but from a combination of gases occasioned by the lifting of the junction-valve when there was not a sufficient pressure of steam. The consequence of the junction-valve being opened under these circumstances, would be, that the steam would rush into the boiler from the adjoining ones, and, by generating gases within it, blow it up.'

"The opinion of the jury can scarcely be regarded as otherwise than hypothetical, and as being entirely unsupported by experience.

"The view that the boiler exploded from excessive and unusual pressure, consequent upon the safety-valve and junction-valve being both closed at the same time, is thought to be an unnecessary supposition, considering the workmanship of the boiler, as well as its condition and the treatment it received, all of which have been previously described. A boiler, roughly made as this was, of plates of excessive and varying thickness, having an unusually wide overlap, and being in a leaking condition, with its seams choked up with bran and horse dung, such a boiler when exposed to the action of an external fire would be utterly untrustworthy, and the mere pressure of steam by no means the only element of weakness. Such thick plates, unless most kindly laid together, would be fighting one against another, especially under the action of the fire, when unequal expansion, aggravated by the varying thickness of the metal, would be sure to ensue. Moreover, had the pressure in the boiler at the time of explosion been higher than that at which it ordinarily worked, or indeed equal to it, viz., 40 lbs., the main portion of the shell would never have remained so near to its original seating as it did, and thus the position of the fragments can only be accounted for by the supposition that the steam was low at the time of explosion, which is borne out by the fact that there was not power enough to drive the engines, and they were stopped in consequence.

"This explosion, therefore, can only be regarded as an additional illustration of the dangerous character of the externally-fired boiler, especially when improperly repaired and carelessly attended to. The constant allusion to such cases may be tedious; but the subject is only recurred to on the repetition of explosion; and it is trusted that the persevering statement of these facts will assist in removing from general use so dangerous a class of boiler as those externally-fired have proved theselves to be.

"No. 39 Explosion, which was attended with the death of one person and injury to four others, occurred to a boiler working at a cotton mill, and not under the inspection of this Association.

"The boiler, which was fifteen years old, was of plain double-flued construction, internally-fired, and of the class termed Lancashire, its length being 32 ft., its diameter 8 ft. in the shell, and 3 ft. in the flues. It worked alongside of another boiler very similar to itself, and to which it was connected.

"The boiler had rent at the bottom of the shell, immediately over the mid-feather wall on which it had rested. This rent, which may be termed the primary one, extending longitudinally for about two rings of plates, and then assumed a transverse direction, running completely round the boiler and severing an entire, though rather irregularly-shaped, belt from the shell. The front end plate was separated from the other part of the boiler, while the furnace tubes, which appeared perfectly sound remained attached to the rest of the shell, which had been thrown out of its original seat and turned bottom upwards. The longitudinal stays for stiffening the end plates, though massive, were curled up into a scroll, and the transverse ones, which should never be introduced in a cylindrical boiler, proved, as might have been expected of no assistance in strengthening the shell.

"The damage to the surrounding property was serious, a considerable portion of the mill being unroofed, and one of the side-walls blown down, while the boiler-house was reduced to a heap of ruins.

"As to the cause of the explosion there can be no question; there was no evidence of shortness of water, the furnace crowns being uninjured; but on examining the edges of the plates at the primary rent, which had occurred over the mid-feather wall, their thickness was found to have been so reduced by external corrosion as not to exceed that of a halfpenny piece.

"In the scientific evidence given at the in-

quest, the plan of setting boilers upon mid-feather walls was strongly condemned, and the corrosion so frequently induced, and at the same time treacherously concealed by them, clearly pointed out. Of the truth of this there can be no question; and it is difficult to say anything more upon the danger of these mid-feathers than has already been said in previous reports, while the occurrence of the explosion in the present instance affords an additional illustration of the correctness of the views so frequently expressed.

"The jury considered that this explosion would have been prevented by due precaution on the part of the owner, and therefore brought him in guilty of manslaughter."

NOTES FROM THE NORTHERN COLLIERIES.

No. II.

COLLIERY ENGINE BEAMS.

SUCH appear to have been *the facts*, with respect to the circumstances of fracture of the Hartley Colliery engine beam, as given in our last part. The question is, what broke it? Every one must see how important a practical question it is, in any view of the subject; but should it turn out that there is great doubt that the true cause of fracture has ever yet been discovered, it will be agreed that this is a practical question still deserving of the most careful discussion. For we shall profit but little by an accident so grave and terrible in its results, if we remain satisfied with any *ex cathedra* explanation, which may not bear the test of exact examination, and which therefore would in such a case be likely only to mislead, as to any constructive modifications that might be hereafter based upon it.

Several guesses were, at and directly after the time of the accident, hazarded, with more or less show of probability, to account for the fracture; some of these we need not repeat. Amongst the more notable of the remaining, were those which attributed the fracture to simple dead working pressure, long continued, upon a beam never adequate safely to its increasing load. One was that which attributed the *first commencement* of fracture to the fall of the beam, a few days before the accident, from off the screw-jacks, back on to the centre bearings, while new brasses were about being put in, and that the final smash was only the gradual enlargement of the original crack. Another was that the centre bearing shaft had been keyed in, with its 24 taper keys, needlessly and dangerously tight, and that the effect of the difference in contractility between the beam and the centre bearing, shaft and keys, affected by the intense severity of the winter cold, had been to produce a bursting strain at the centre of the beam, that left very little to be done by a load or blow, in order to break it off short across. A fourth assumed that one or both pump buckets in the pit shaft had got wedged somewhere about the middle of the stroke, and that the beam was broken by the sudden arrestation of its movement as the engine was going indoors.

For the present, we may dismiss all these, as having none of them sufficiently taken account of the actual facts, and indeed not received any general assent, and take the official declaration of Mr. Blackwell's Report to the Home-office, as containing the accepted dogma as to *how* the accident was produced, and then consider whether the conclusion enunciated in that report be sustainable or not, when examined by the rigid rules of dynamics.

To whatever result the investigations may ultimately lead us, we must not be misunderstood as casting any reflection upon Mr. Blackwell's Report—an able and clear document, although, as we think unfortunately, its author contents himself with the enunciation of a dogmatic opinion only, as to the circumstances that produced the fracture, and has not sustained his view by any appeal to calculation.

The problem itself is a dynamic question of considerable complexity, as is pretty evident from the fact that, so far as our knowledge goes, not one of the many able colliery engineers of the North, no one indeed, has ever attempted to grapple with it, up to this date, when the accident itself is almost beginning to be forgotten.

But, first, let us set aside one or two of the popular views on the subject, as amongst those that, it may be pronounced with certainty, *could not possibly* account for the fracture. First, it cannot have broken simply by statical overloading, long continued. A writer in the *Engineer* (Feb. 28, 1862) calculates the statical strength of the beam from the common formula—

$$\frac{(BD^2 - bd^2)\ 0{\cdot}25\ S \times 4{\cdot}5}{L} = W,$$

the breaking weight; and upon he data following—

B = 8 inches; D = 98 inches, the full length of the line of fracture;
b = 3·25 inches; d = 86 inches; and
L = 18 feet; S = 296 lbs. for a bar of cast iron 1 inch square;

and arrives at the conclusion that the ultimate breaking weight of the beam was = 976,707¼ lbs., or about 436 tons; and calculating the greatest dead load upon the beam at 64,641¼ lbs., or under 29 tons, and deducting 10 per cent. from the first value of W for defective casting (*i.e.*, the draw holes at the bosses), he points out that the statical load was no more than $\frac{1}{13{\cdot}5}$ of the breaking strain.

This is the smallest estimate that we have seen made in figures, of the passive strength of the beam, and it undoubtedly underrated both the breaking weight and the load.

A more trustworthy calculation was given by Mr. Atkinson, Government Inspector of Mines, in Vol. XI. of the "Transactions of the Northern Mining Institute."

From the formula—

$$\frac{500 \times BD^2}{L} = W;$$

and upon the data that the statical breaking weight of a bar of sound cast iron 1 in. square, and 1 ft. long, *encastre* at one end, and loaded at the other, is = 506 lbs. reduced to 500, as the beam was unsound at the bosses; and taking *mean* values for B and D, the line of fracture being 8 ft. 2 in. deep, he calculates the value of

W = 1,413 tons 8 cwt. 3 qrs. 18 lbs.

But the statical load, or "greatest steady strain," he says, did not exceed 106 tons 8 cwt. 3 qrs. 1 lb., acting at 18 ft. from the line of fracture, from which it follows that the greatest load was only about $\frac{1}{13{\cdot}25}$, the ultimate strength. The two ratios' though on independent and different data, closely coincide.

Now, as it is perfectly well known that, even under impulsive strains, cast iron may be exposed to forces producing more than one-fifth its ultimate extension, and remain for decades of years uninjured, there can be no hesitation in pronouncing that it is physically impossible that the Hartley beam was broken by the long-continued action of its steady load, even making every estimate of allowance for the variable nature and alteration of that load.

In what follows, we shall find that Professor Haughton has examined the question arising out of one of the other suppositions as to cause—namely, the possible strain that might have been visited upon the beam by the fall it got from off the screw-jacks.

That view alone *looked* feasible, because it was beyond the reach of the judgment we form by tactile experience of such things; no one could, by any analogy of experience, imagine what might be the stress upon such a mass of 42 tons, dropping upon two points at its mid length, from even a few inches in height.

Let us come, then, to what we may call the authorized version of the conditions that produced fracture. After describing the engine, the beam, and the loads which he calculated were upon it, Mr. Blackwell states:—"It appeared from the evidence of the men being wound up in the shaft at the time of the accident, that *a breakage of the spears in the shaft, by which the engine lost its load wholly or in part*, did occur prior to the breakage of the beam and the fall of its broken half into the pit;" "and that when this breakage of the spears did occur, the engine was commencing its inside stroke." Report, p. 32.

He proceeds:—"The resistance to the descent of the piston in the steam cylinder being thus removed, the piston would be carried downwards by the pressure of the steam on its upper surface, augmented by the vacuum below, amounting to a force of about 62 tons, and would rapidly acquire momentum in its descent through a stroke of 10 ft. in length, until both the piston and that end of the beam connected to it were suddenly arrested by the iron catch-pin, fixed upon the beam at that point, coming down upon the spring beams, where they were rendered perfectly rigid in their resistance by vertical cast iron columns beneath them."

"The engine beam was of iron of *fair quality*." "It was of the full ordinary sectional dimensions of beams used in engines of similar power." "The over-wedging of the beam centre *may have contributed* to render it *more liable* to fracture," but is "not alone sufficient to account for the fracture."

"*The breakage of the beam must be attributed to the violent concussion to which it was subjected*, when it, together with the steam piston connected to it, were suddenly arrested, after descending through a stroke of 10 ft., with the velocity acquired under the pressure of the steam, by coming in contact with the beams beneath, after the counterbalancing load in the shaft was partially or wholy lost."—Report, p. 32.

Such, in clear language, is Mr. Blackwell's decision. We shall, without further preface, submit it to the calculus of Professor Haughton. In the present section of these "notes," we cannot do more than give the preliminary investigation made by that gentleman, upon data supplied by us, and not rigidly exact, and which he desires shall be received as no more than a first approximation to the problem of the Hartley beam. Upon more precise data, as to loads and dimensions, form of the beam itself, &c., since then obtained, Dr. Haughton is still engaged with the calculation; and we hope in a succeeding part to give fully his exact determination of the strain possible to be produced by the train of circumstances set forth by Mr. Blackwell. Meanwhile, the following calculations will show the methods employed, and indicate the probable result of the final investigation.

APPROXIMATE SOLUTION OF QUESTIONS RELATIVE TO THE FRACTURE OF THE HARTLEY BEAM, BY REV. SAMUEL HAUGHTON, F.T.C.D., F.R.S.

PROP. I.—PROBLEM.

A beam, of rhomboidal shape, is supported by an axis passing through its centre, and loaded with equal weights at its extremities; it is required to find the tension and compression to which its parts are exposed.

Let l denote half the total length of the beam,
Let d, its depth,
Let t, its thickness;
Let W denote the weight of the beam,
and P, the weight suspended at each extremity.

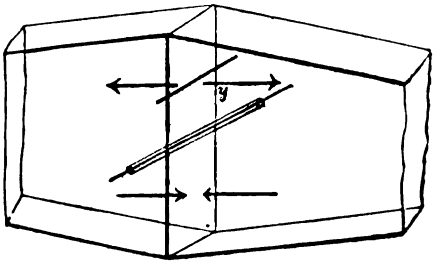
The *Moment of rupture* of the beam is equal to

$$\frac{(W + 6\,P)\,l}{6};$$

and the *Moment of resistance to rupture* is

$$t \int F y\,dy;$$

where F denotes the tension or compression per square inch at any distance y from the axis of the beam, in its central vertical section (*see* fig.). If C



denote the tension or compression per square inch at the top or bottom of this section, then (assuming for the present that the *neutral axis* passes through the centre of the beam), we have, by Leibnitz's principle,

$$F = C\,\frac{2\,y}{d}$$

therefore, equating the moments of rupture and resistance, we have

$$\frac{(W + 6\,P)\,l}{6} = \frac{2\,t\,C}{d}\int y^2\,d\,y = \frac{2\,t\,C}{d}\cdot\frac{y^3}{3} + \text{Const}\ldots(1)$$

This integral must be taken for the extended portion of the section, from $y = +\frac{d}{2}$ to $y = 0$; and for the compressed portion from $y = -\frac{d}{2}$ to $y = 0$; or, since both extension and compression are employed in resisting rupture, from $y = +\frac{d}{2}$ to $y = -\frac{d}{2}$;

therefore

$$\frac{(W + 6\,P)\,l}{6} = \frac{C\,S\,d}{6}$$

or

$$(W + 6\,P)\,l = C\,S\,d \ \ldots\ldots\ldots\ldots\ldots(2)$$

where $S = t\ d$ = the cross sectional area of the central vertical section of the beam.

herefore, finally,

$$C = \frac{(W + 6\,P)\,l}{S\,d} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Example 1. If the beam be 34 ft. long, 8 ft. deep, and $9\frac{1}{2}$ in. thick, weighing 42 tons, and be loaded with 300 tons at each end, find the strain on each square inch of the top of the vertical central section—

$$C = \frac{(42 + 1{,}800)\ 17}{912 \times 8} = 4{\cdot}292 \text{ tons per square inch.}$$

Example 2. If the beam be unloaded, find the strain per square inch—

$$C = \frac{42 \times 17}{912 \times 8} = \frac{1}{10{\cdot}2}\text{th of a ton per square inch.}$$

Example 3. If the maximum strain that cast iron will bear, if *suddenly* applied, be 2 tons per square inch, calculate the forces, P, suddenly applied downwards to the extremities of the beam, that will just fracture its upper surface in the central section. In equation (2), write $C = 2$, and solve for P.

$$(42 + 6\ P)\ 17 = 2 \times 912 \times 8$$
$$714 + 102\ \ P = 14{,}592$$
$$P = 136 \text{ tons.}$$

—*Practical Mechanics' Journal.*

ON STEERING STEAM AND OTHER VESSELS.

By Commander F. P. Warren, R.N.

It is undeniable that the great length of modern ships (combined with the daily increasing necessity for rapid manœuvring), calls for some means of guiding their movements with greater ease and certainty than those afforded by the ordinary stern-rudder.

Reasoning by analogy, it is also evident that the attempt to control the movements of these lengthy vessels from one end alone, is wrong in principle, as shown by the manner in which nature effects a similar object. In doing this, however, we must not take aquatic birds as our example, as in their case the body is comparatively short, and is, moreover, provided with *two* propellers of considerable length, and so situated as to enable the creature, by working either one or both, as required, to regulate and control its movements with the greatest ease and certainty. It will, therefore, evidently be more correct to compare modern vessels with certain species of long-bodied fish. These, it is true, have their principal means of steering, namely, the tail, situated in a position somewhat similar to that of the stern rudder in ships; but here it will be found that the similarity ends, inasmuch as the body of the fish is flexible, and capable of accommodating its curves to the directions in which the creature desires to move, while that of the ship is entirely rigid, and incapable of any change of form tending to assist the action of the rudder.

It is evident (from the numerous and insurmountable practical difficulties such a construction would involve) that we cannot for a moment entertain the idea of making the body of a vessel capable of curvilinear movements, similar to those of a fish. But although such is the case, there is nothing to prevent the employment of a rudder at the forward as well as the after end, thus to some extent approximating to the perfection of nature, and giving a facility of control entirely unattainable where the ordinary stern-rudder only is employed. By this means, it is obvious that the vessel will be caused, in turning, to describe a circle of very much smaller diameter than if a single stern-rudder only were employed.

A well-known cause of difficulty in steering screw-steamers, arises from the action of the screw, which, by breaking the current of water, prevents its acting as in sailing-vessels directly upon the rudder. The water thus churned and broken by the action of the screw, loses much of its density, or power of resistance as a steering medium, and is hence greatly reduced in effectiveness. If this is attempted to be overcome simply by an increase of the area of the stern-rudder, it at once becomes necessary to make use of more powerful and complex machinery for actuating it, thereby involving increased liability to strain the stern-post, endangering the rudder-head, weakening the rudder itself, and consequently threatening danger to the ship, and to the lives of those on board.

In the plan now proposed, a safe auxiliary to the rudder astern, is placed in the dead wood of the bow—an arrangement which the fine line of present vessels, both war and mercantile, renders very easy of adoption; the aperture to receive the bow-rudder being formed abaft the stem, in the same manner as one is now constructed in the dead wood at the stern for the purpose of receiving the screw.

It is scarcely necessary to ... out the advantage of having two rudders ... ndent of each other, and not liable to be damaged at one and the same time by the same causes of accident; the bow-rudder being merely for use in narrow waters, and on occasions of difficulty and emergency, such as steering through a narrow and tortuous channel—coming suddenly upon a reef or strand—or in thick weather, upon a vessel, which the present rudder alone would not have sufficient stopping or turning power to avoid.

A reference to the inquiries into the loss of steamers, carried out under the direction of the Board of Trade, will show how numerous are the cases of vessels being stranded, owing to the length of time lost in coming round after the danger was seen. In such cases, the additional steering power, and facility of turning or backing off, afforded by the extra rudder would be of vital importance, and would prove the salvation annually of many of our mercantile steamers, and hundreds of lives.

In a gale of wind, when a steamer can but just head the sea, the stern-rudder would be greatly eased by the bow-rudder's acting to keep the ship's head up, thus enabling an easy helm to be carried, instead of the stern-rudder being jammed hard up to its great danger, and that of the ship. The case of the "Great Eastern" is one in point, and by her narrow escape from foundering when falling off from the sea after the accident to her *only* rudder, convincingly proves the necessity for an auxiliary, to which recourse can be had either for assisting the main rudder under peculiar circumstances, or for acting alone, when it, the main rudder, is disabled.

In cases of vessels striking the ground, the stern-rudder is frequently lost, and generally damaged; and, in consequence, merchant vessels which, under these circumstances, escape total loss, are obliged to go into port, requiring extensive repairs, and causing serious, if not ruinous, loss by delay, to owners, shippers, and consignees, which, in the case of a vessel fitted with an auxiliary rudder, would be avoided by the vessel being enabled to make a safe passage without incurring the disastrous loss of time, &c., referred to.

The advantage also of having a vessel under perfect command while going astern, can scarcely be overrated. At present a screw-vessel under such circumstances, is unmanageable; but, fitted with an auxiliary rudder, the largest vessel of this class would be able to leave its port or harbour without having to swing or wait for a tide.

Steam-tugs, so fitted, could, while under sternway, place themselves under the bows of a vessel with perfect safety and certainty.

To men-of-war it is undeniable, that an auxiliary rudder, entirely protected from shot, must be a great advantage in action: besides which it is to be borne in mind, that vessels of a large draught of water, as now fitted, invariably steer much worse in shallow than in deep water, and are, therefore, least manageable at the very time when their immediate answering to the helm is of the most vital importance, as when going into harbour, attacking shore fortifications, &c. The following extract from the "Transactions of the Institution of Naval Architects," page 139, vol. i., is the opinion of Rear-Admiral George Elliot, Assoc. I.N.A.:—"I believe that if a war broke out to-morrow, the commander of the fleet would call out all the paddle-steamers as auxiliary vessels; they are serviceable in action in a manner that screws cannot be. *The screws cannot back astern effectively, and cannot run under the bows and take a vessel in tow with the facility of a paddle-wheel.* I therefore think before the paddle-wheel steamer is condemned altogether, as has been the case, one word should be spoken in her favour for war purposes."

The auxiliary rudder, as explained, enables a screw-steamer to carry out in a perfect manner the manœuvres which an officer of Admiral Elliot's experience puts forward as a sufficient reason for pausing ere doing away with a class of vessels which, in other respects, is obviously far inferior to the screw for war purposes, and would only at best be retained for possessing qualities which it has been shown may be readily and simply given to the screw.

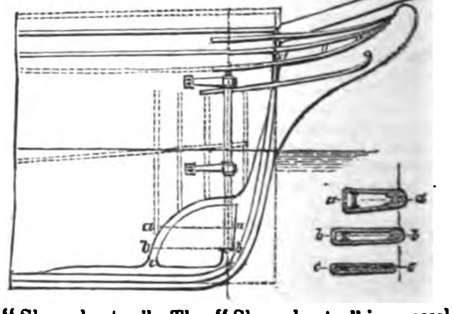
1. If the bow and stern rudders be considered as levers of the first order, the bow-rudder would have the same power to pivot or turn the vessel as the stern-rudder, if the areas be the same and the centre of displacement equidistant from each, the form of the vessel at either end being identical. The only vessel which we have in our service where an attempt has been made to fit her with a bow-rudder, is the "Weser," built by Mr. Scott Russell for the Prussian Government, and which was exchanged, together with the "Recruit," in 1853 or the beginning of 1854, for one of our frigates. An officer commanding the "Recruit," says:—"The bow-rudder was useful in the 'Recruit.' She has often gone out of harbour one end first and come back the opposite way for convevenience in taking in moorings. In harbours, and in the river Danube, it has often been used successfully to prevent the necessity of turning. I could not use it with success in starting from an anchor, or in conjunction with the after-rudder for turning purposes."

I may here observe, that, during the last Chinese war, the French gun-boats in the Peiho were fitted with bow-rudders; but they were of the same description as the stern-rudders. I have obtained the opinions of officers who were out there; but every one of them gives me an opinion, so far as I can judge, according to what he thinks the rudders did, for nobody can tell me distinctly how they really acted. No doubt they had full command over the vessel in going astern; but if the bow-rudder in the "Recruit," of which we have perfect data, had no power when going ahead, I cannot see how the French gun-boats could go ahead under command with their bow-rudder. They are fitted on exactly the same principle. They have a spindle outside the stern, and it is the same rudder as that in the "Recruit."

I now come to the trials which have been made with the "Princess Royal," and which, I may safely say, will establish the practicability of this rudder, or the Government would not have adopted it in the "Sharpshooter." The "Princess Royal" is one of the Ryde boats, a vessel of about 110 tons. She was the only vessel I could get, the manager of the company having kindly allowed the experiment to be tried in her, she being ready for launching from the slip. There was only forty-eight hours to fit her. So that instead of having the rudder placed as I should wish to place it, in the dead wood, as in the "Sharpshooter," which would have involved a good deal of work, I had the keel lengthened and an additional stem put on. The areas of the bow-rudder to stern-rudder were as 9 ft. to 15 ft. I may here mention, as is well known, that in a paddle-steamer when she begins to go ahead, the tendency is to draw down by the stern; so that the stern-rudder as fitted in that vessel became more immersed the faster she went, while the bow-rudder was proportionately lifted, losing power. Besides, the narrowness of the stem in this vessel, which I will point out when we get further into the question of fitting, produced a very great disadvantage on the action of the rudder.

I may as well point out that the difference between this and almost all other bow-rudders that have gone before it, is the manner in which it is hung. The spindle is in the after part in every other rudder. I believe there is a rudder that shifts on the stem, fitted in the same manner as mine; I have not seen it, but from the experiments I have tried, I cannot conceive that it has any active power in steering a vessel. Another is hung on or in an outer stem, but not in the dead wood as in the "Sharpshooter," which is the point where the power is gained, as the further aft in the vessel's bow the rudder can be placed, the greater the power.

My bow-rudder is entirely protected from shot. The drawing shows how it is fitted to the



"Sharpshooter." The "Sharpshooter" is a vessel with a light draught of water. If the rudder were fitted to the "Warrior," the men who steered the ship would be from 6 ft. to 8 ft. under water. And if the upper tiller were shot away, not only the rudder itself but the men who steered the ship by the lower wheel, would be completely protected from shot.

Another feature is, that the power of steering a ship when going astern is equal to the present rudder when steering a vessel when going ahead. I

take this from the report of Captain Coles:—The areas of the two rudders being as 9 ft. to 15 ft.; the stern-rudder going full speed, head to port, was 3 min. 9 sec.; going at half speed, 3 min. 10 sec. With the bow-rudder alone, at full speed, it was 5 min. 34 sec.; at half speed, it was 5 min. 17 sec. This, within a fraction, gives the exact ratio between 9 ft. and 15 ft.; that is to say, the area of 9 ft. bow to 15 ft. stern, is as 3 min. 9 sec. to 5 min. 34 sec. Going astern the circle was completed with the stern-rudder, at full speed, in 6 min. 56 sec.; at half speed, in 6 min. 11 sec. But here the bow-rudder has an immense gain, for at full speed the circle was completed in 4 min. 20 sec., and in 4 min. 20 sec., singularly enough, at half speed. We cannot arrive at any reason for this, but it is the simple fact that there was a difference of 45 sec. between full speed and half speed with the stern-rudder, and no difference at all with the bow.

At first sight, it would appear that when the ship is going astern, there is an enormous action exerted on the rudder to tear it off its spindle. Practice does not give that result. It has been tried repeatedly. In the "Princess Royal," it was only a temporary thing, and fastened with inch bolts; the gudgeon was one-eighth iron and a simple strap. On one of the trials when going astern, steered by the stern-rudder, at full speed, the rudder got across the ship's stern, and became unmanageable, and the tiller was bent double in trying to right the helm; while on going astern full speed with the bow-rudder, and the rudder being let go hard over, it was righted again by one man; the length of both tillers were the same. One man was able to right the bow-rudder, while three men broke the tiller of the stern-rudder in trying to right it. This, I think, can be accounted for by supposing that the current of water which passes through the aperture, when the rudder is put over, takes away that apparent resistance which we find with the stern-rudder, when we bring the rudder over at a certain angle, we bring it over against a fixed body, and we are piling the water up against it; in the other case we do not bring it up against any fixed body, we only have the resistance of the water itself.

The next point is the very small area in making the circle when both bow and stern rudders are worked together. There were two trials under the superintendence of Captain Coles, and two trials under Captain Broadhead; and at both these trials there was, as near as one can judge without measurement, a reduction of 50 per cent. in describing the circle when both rudders were used in conjunction. The gain of time was small; at the best it was not more than 14 sec., but the area was reduced 50 per cent. Where we wish to stop a vessel suddenly, there would be great advantages in two rudders, because we would put the bow-rudder over one way, and the stern-rudder over the other, and we would have a stopping power at once, the one rudder balancing the other.

I shall now refer to Captain Broadhead's report of the trial in the "Princess Royal." In this vessel, from some cause or other, which we only found out after she was docked, a difficulty was experienced in making her complete the circle to starboard. It arose from the crookedness of the keel, which had been put on out of the straight, so that she carried, under ordinary circumstances, a strong port helm, and she could not be got round in one way for some time; but at the trial by Captain Coles, and by humouring her, the circle was completed to starboard; that being done, it satisfactorily proved that the rudder acted perfectly, but the fault in steering arose from the malformation of the vessel. This was the opinion of the Government officers.

Trials of Commander Warren's Plan of Steering.
24th July, 1862.

SIR,—In pursuance of instructions communicated in your memoranda of the 19th inst., to witness Commander Warren's plan of steering with a bow-rudder, as fitted to the "Princess Royal," Ryde packet, we have to report that we yesterday made the following trials, but must first observe that the vessel is ill-adapted for the purpose, as from some unexplained cause, probably a bend in the keel, the stem not being perfectly upright, or malformation in the bottom, while the bow-rudder acts readily in turning to port, it is nearly useless in turning to starboard.

1st Trial.—In Harbour.—Proceeded from off dock-yard at full speed, through the ships to the entrance of Fareham Lake, above Hardway, where the vessel was turned and taken to Spithead. Throughout the distance she was steered with the bow-rudder, except when making the turn up the harbour, and when avoiding objects on the port side, when it was found the port helm had no effect.

	min.	sec.
2nd Trial.—At Spithead.—With stern-rudder, helm hard astarboard, vessel made circle in	3	13
With bow-rudder placed as above, vessel made circle in	7	9
Gain of stern-rudder over bow	3	56
3rd Trial.—With stern-rudder, helm hard aport, vessel turned in	3	45

With bow-rudder placed as above, vessel only turned 8 points in 7 minutes, and would have gone on shore before turning. The attempt to turn her was therefore given up.

	min.	sec.
4th Trial.—Vessel was stopped dead. The helm of bow-rudder was put hard astarboard, vessel made circle in	6	54
5th Trial.—With both rudders, vessel made circle to port in	2	51

The small circle in which the vessel was turned was very remarkable.

	min.	sec.
6th Trial.—Vessel going astern at full speed, made the circle with after-rudder, helm hard astarboard, in	7	29
Under similar circumstances, with bow-rudder, in	8	27
Gain of stern over bow rudder	0	58
7th Trial.—Vessel going astern at full speed, helms of both rudders hard aport, vessel made circle in	5	0
Or a gain of stern-rudder only of	2	29

To conclude the trials, the after-rudder was locked when about a mile distant from Ryde Pier, the vessel put at full speed, and the bow-rudder only used, when she steered stern foremost in the most perfect manner, passing through the ships at Spithead up the harbour past the dockyard, when she was turned without the stern-rudder being touched.

The comparative areas of the bow with the stern rudder is as 9 to 24.

From what we have observed, we think the bow-rudder to possess about half the power of the after one when steering ahead, which would doubtless be increased were the area of the two rudders more nearly equalized, to give a fair estimate of its power.

In conclusion, it appears to us that the invention is of value, but think it capable of great improvement in its details.

We return herewith Commander Warren's model and papers, and have, &c.,

(Signed) H. BROADHEAD, Captain in charge of Reserve.
I. TONKIN, Master Attendant.
H. CRADOCK, Master Shipwright.

I have no doubt many know what nice steerage it requires threading the way amongst the ships in ordinary of Portsmouth Harbour.

Turning now to the subject of vibration. Up to this time I have only spoken of the rudder as an auxiliary rudder. But I have hopes that this rudder will be able to be used as a main rudder at sea, and this would lessen the vibration of the screw, which we know increases, in a very great degree, directly the helm is put over, and piles the water against the screw. If we steer by the bow-rudder we do away with the increased vibration caused by steering with the after-rudder. Scarcely a month passes that we do not see some of our finest ships returning to port to repair leaks in the stern-post caused by the vibration of the screw.

In conclusion I will deal with the application of the bow-rudder in sailing vessels. So fitted, a sailing vessel has two chances of staying instead of one. If we put the helm down, the vessel comes up head to wind, and then gathers stern-way; we shift the helm and square the yards, and with the stern-way she comes round and answers her helm. It is impossible for a vessel to miss stays, for she can go round as certainly going astern as when she is going ahead.

CASTING HEAVY GUNS.

THE principle involved in the construction of ordnance on the Rodman system, is simply that of cooling the core round which the metal is poured by passing a current of cold water through it; thus equalizing the contraction, and adding enormously to the strength of the gun. The system has not as yet been adopted in this country, and therefore the following, for which we are indebted to the *Pittsburgh Dispatch*, is not devoid of interest:—We have already noticed the fact that preparations were progressing at the Fort Pitt Works, in this city, for the manufacture of 20-in. guns, the lathe, patterns, &c., being in an advanced condition. As the experiment of manufacturing a gun of such a calibre, however, is one of great risk, it was determined to settle at least one point practically before attempting to mould the great gun, by melting at a single heat, nearly the same quantity of metal as would be required for the 20-in. For this purpose, two guns were moulded of the 15-inch navy pattern, and each furnished with a 12-in. instead of a 15-in., hollow core, making the round weight of each of the guns nearly as great as the columbiad 15-in. These moulds were placed side by side in the pits of the new foundry, and five of the furnaces in the foundry were charged—three for the special purpose of casting great guns, and two for the ordinary work of the shop. The respective weights of these charges will give some idea of the capacity of these enormous furnaces, being 34, 19, 19, 13, and 18½ tons—an aggregate of nearly 94 tons. 72 tons of this metal, being the charge of the three large furnaces, were designed for the casting of the experimental guns. The metal was led from each of these furnaces to a large pool, equidistant from each of the moulds, and communicating by two "runners" with the two "gates" of each.

About mid-day, the three furnaces were tapped in quick succession, and in a moment three streams of molten iron were pouring into the pool, from which, as the metal rose to the level of the openings, two fiery lines shot into each of the moulds. Notwithstanding the unusually risky character of the experiment everything passed off successfully, and the streams of hot metal and cold water, crossing and interlacing on their way, poured into the moulds without accident.

MANUFACTURE OF BOOTS AND SHOES BY MACHINERY.

THE old system of making boots and shoes entirely by hand labour will soon, to all appearance, be numbered with the relics of a past age. The war having created an immense demand for boots and shoes, hand labour was found unequal to the task of supplying it; but necessity—well-named "the mother of invention"—soon provided a remedy. Machines have been constructed and are now in use executing the different operations necessary to the manufacture of such articles, and with a rapidity and accuracy of action which far excel the efforts of hand labour. A manufactory in which boots and shoes are made upon an extensive scale, by machinery, has been recently established in New York and is thus described by the *Scientific American*:—

Three large apartments are occupied by the operatives, mechanism, and goods. The skins for the uppers are first spread out, examined, and selected according to the purposes for which they are required. Different cutters then cut out the respective parts according to the size and form required, and these are all arranged and classified. After this, these separate parts are given out in lots to be sewed by machines, and those uppers which are intended for boots are crimped, and the whole made ready for receiving the soles. The more heavy operations of punching, sewing, pegging the soles, and finishing the articles are next executed. The sole leather, in hides, is first steeped in a tank of water to soften it; then it is thoroughly dripped, and afterwards cut by a machine into measured lengths of a certain breadth, according to the size of the sole wanted. After having become sufficiently dry, these cut strips of leather are run between rollers, and also submitted to severe pressure under plates in a press, so as to effect as complete a compression of the fibres as is attained according to the old mode by beating with a hammer upon a lapstone. From these compressed strips, soles of the different sizes are punched out at a single blow by a machine, the cutter of which is of the size and form required, and it turns round so as to cut a right and left sole alternately. Heel-pieces are also cut out by hollow punches at a single blow. The edges of the soles and heels are next smoothed and polished in a small rotating machine; and another machine then makes the channels in the soles for the rows of stitching. After this, the under soles and uppers are fitted upon lasts and made ready for sewing. This operation is executed by Mackay's peculiar machine, adapted for this specific purpose. The waxed thread is wound upon a vertical spool, and is conducted through a guide situated on the top of an elbow secured on a swivel joint capable of turning under the needle, and conducting the thread into the crease around the sole. The needle operates vertically above the sole, and the waxed thread is fed into the interior of the boot or shoe

by the guide, the needle descending through the sole, drawing through the thread and forming the stitches, which are pressed down close into the crease by a tracer-foot, upon which great pressure is exerted. In this manner the sole and upper are united firmly and neatly together in a few seconds, without employing a welt. Hand-sewing cannot be compared with such machine-work for accuracy and rapidity. Another machine is employed for putting on double soles with copper pegs. A thin strip of copper is fed in at one side and the holes are punched in the sole, the pegs cut and put into the holes, and then driven down at one continuous operation, with a speed corresponding to that of sewing the soles. The crossing of the half sole at the instep is pegged, and also fastened with a screw at each side by hand; the heels are also pegged down. The edges of the heels are neatly trimmed by a small rotating machine, and the soles are also rubbed down by a machine; so that nearly all the operations connected with the manufacture of boots and shoes in this establishment, are performed by machines designed especially for the purpose. The legs of the boots are stretched and the wrinkles removed by new boot-trees secured to benches and are expanded in an instant from the interior by pressing on a treadle with the foot. These boot-trees are altogether superior to the clumsy old wedge kind. The materials used in the manufacture of these articles appear to be of a superior quality, the machines not being adapted for operating on inferior patch leather. Another novel feature connected with these machines is that they are driven by one of Roper's hot-air engines, illustrated on page 97, Vol. VIII. (new series) of the *Scientific American*. It has been running for several months, requiring but little attention and consuming a very small quantity of fuel. The accurate operations of these machines and the rapidity of their action place them in a highly advantageous position for manufacturing boots and shoes. The price of hand labour had become so high, and workmen so scarce, that such machines became a necessity, and the change effected by their use is equal to four times the quantity of work executed by hand labour —that is, one hundred men will turn out with these machines as much work as four hundred men without them. The saving of labour to the country is therefore immense. About 500 pairs can be turned out daily in this establishment. Perhaps no labour connected with boot-making is so severe as that bestowed upon burnishing the heel with a warm iron. This work is still executed by hand, but a machine is now being set up to accomplish this finishing operation, and it will soon be at work. For centuries no improvement seems to have been made upon the old system of boot and shoe making; when, all at once, as it were—within the space of two short years—the whole art has been revolutionized.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—L. T., Col. G., C. W. W., J. W. G., H. J., L. T., G. S., L. D., J. H., J. N., R. P. E.

FAN (Birmingham).—By making the shape of the blades elliptical, you can reduce the noise. The improved French fans have a central disc instead of spokes.

IGNORANCE.—We doubt that any advantage would be derived from working dock capstans by steam power, except in exceptional cases. We do not see very clearly how a screw-jack could be worked in confined situations by a hand wheel.

C. Y. (Manchester).—We cannot say.

D. V.—Why not use india-rubber valves? They will work without noise and last a very long time.

Correspondence.

ENGINEERING SOCIETY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—A society has been formed at King's College amongst the students of the Engineering Section, to promote the advancement of a knowledge of this profession by the reading [illegible] and open discussions. Its meetings ar[illegible] 2.15 to 3.30 p.m., on Thursday after[illegible]

Knowing well the interest you always take in all matters that are likely to advance engineering science, I take the liberty to ask you to insert this note in your valuable paper, to the effect that the society will be happy to see any gentlemen from engineering offices who may wish to attend its meetings. A card of admission can be obtained on application to the President.

I am, Sir, yours &c.,
P. MAITLAND,
President for the October Term.

THE RECENT GUNNERY EXPERIMENTS.

SIR,—I beg to forward to you an *authentic* table of the results obtained at Shoeburyness, on Friday last, with my 9-inch gun. These results would have been very much better, had it not been for an accident—namely, that the zinc bearings upon the shot were put on in so inefficient a manner that they were partly or entirely blown off in the gun, thus causing an unusual play of the shot in the bore and affecting their flight considerably. This accident—which the *Times* reporter omitted to mention—cannot occur again. Considering the conditions under which the gun was fixed, the results were much better than could have been expected; the difference in the firing—both as regards range and accuracy—between my gun and the 100-pounder Armstrong gun, being about the same as that which exists between the 100-pounder Armstrong gun and the 12-pounder Armstrong field-piece.

The fact that this 9-inch gun is the first which has stood even thirty-three rounds with a charge in proportion to its calibre, was overlooked by the *Times* reporter. His remarks respecting the cartridges, &c., displayed so complete an ignorance of the subject, that it would be quite a waste of time to do more than give them this notice.

I am, Sir, yours, &c.,
LYNALL THOMAS.

Southend, Nov. 24, 1863.

Round.	Elva. degs.	1st Graze. yards.	Deflection Left. yards.	Deflection Right. yards.
1	2	948	1·6	—
2	"	928	—	1·2
3	"	955	1·0	—
4	"	1029	—	1·4
5	"	999	—	·8
6	"	958	1·2	—
7	"	928	2·2	—
8	"	939	—	2·6
9	"	971	—	4·0
10	"	1092	—	1·0
11	5	2107	—	8·0
12	"	1883	—	1·0
13	"	2073	—	9·4
14	"	1958	—	2·4
15	"	2082	—	3·0
16	"	2042	—	3·4
17	"	2123	—	4·0
18	"	1945	—	6·4
19	"	2161	—	1·2
20	"	2095	—	6·0
21	10	3635	—	33·0
22	"	3768	—	18·4
23	"	3775	—	14·0
24	"	3795	—	7·8
25	"	3921	—	19·0
26	"	4007	—	19·2
27	"	3569	—	27·0
28	"	3863	—	21·0
29	"	3680	—	13·0
30	"	3731	—	13·6

DRAWING PENS.

DEAR SIR,—I cannot think that I am the first who has remarked the following, but now beg of you to make it public, that we may, in a few years, get rid of the nuisance of having so universal an instrument as the drawing-pen incorrectly constructed.

The essence of an even line is that, in inking there should be no change of distance between the two ruling nibs; but to make a line true to the guiding edge, there must be a moderate amount of pressure on that edge. Very few pens have this idea predominant in their construction; there should be extra stiffness in one or both the nibs. The extreme bulging and "lengthy" forms of these are quite unnecessary and ugly, and the hinged ones, often, a little gained and much lost. Let the inner nib (in ruling) be, say, twice as stout as usual; the outer one half as stout again especially flatwise; the screw twice as large in its head, for finer adjustment; and its shank stout enough to withstand the extra strain, and "inking in" will become a pleasure, and the pen-maker will win for himself a thousand blessings.

Having observed this, and experimented upon it for more than ten years, I add with confidence, "Believe those who have tried."

I am, dear Sir, yours truly,
HERBERT HURST.

Meetings for the Week.

MON.—*British Architects*, at 8 p.m.
Medical Soc., Lettsomian Lecture, at 8.30 p.m.
London Inst., "On English Costumes from the Anglo-Saxon Period," by Rev. Henry Christmas, F.R.S., at 7 p.m.

TUES.—*Inst. Civil Engineers*, 1, Renewed Discussion on "Cornish Pumping Engines." 2, "Lambeth Bridge," by P. W. Barlow, Esq., at 8 p.m.

WED.—*Geological Soc.*, 1, "On the Correlation of the Pliocene Deposits of Belgium, Germany, and Southern England," by Herr A. von Koenen. 2, "On the Liassic Strata of the Neighbourhood of Belfast," by R. Tate, Esq. 3, "On Palæozoic Strata in the Vicinity of the Bosphorous," by W. R. Swan, Esq., at 8 p.m.

THUR.—*Antiquaries*, at 8 p.m.
Linnean, at 8 p.m.
London Inst., "On the Principles and Applications of Organic Chemistry," by J. A. Wanklyn, Esq., at 7 p.m.

FRI.—*Architectural Assoc.*, Class of Design—Open Timber Roof.

SAT.—*Association of Foremen Engineers*, "A New Slide Link Motion," by Mr. Stanley, at 8 p.m.

Miscellanea.

Messrs. Childs and Co., of Alleghany, Pa., have been experimenting with flax batting as a substitute for cotton, and have succeeded in producing an article which is pronounced excellent.

The *Commercial Bulletin*, Boston, states that the Putnam Machine Company, of Fitchburg, Massachusetts, have contracted for the manufacture of the heavy guns for the coast defence of the State, and are erecting buildings and machinery. A portion of the guns will be of the Blakeley pattern, weighing from 20 to 30 tons each, and all of them will be rifled, and are designed to throw a projectile weighing from 300 to 600 lbs.

It is with the deepest regret that we state that Captain Shaw, the chief of the London fire brigade, still remains in a very critical state. Our readers are, doubtless, aware that he met with the deplorable accident, from the effects of which he now suffers so acutely, while in that active discharge of his duty for which he is so well known. Many distinguished personages have called at Watling-street Station, and Her Majesty has also sent to ascertain the state of the gallant Captain.

Pneumatic tubes are being laid down between the central telegraph office, the Exchange, the railway stations, and several other buildings of commercial and political—or rather police importance—at Berlin. There will be two steam engines attached to every tube, the one condensing and the other rarefying at either end.

The following letter has been addressed by M. Chevalier, the eminent French political economist, to Mr. R. A. Mactie, of Liverpool, on the subject of the patent laws:—Lodeve (Herault), November 16, 1863.—My dear Sir,—You have made me communications of interest relating to patents for inventions. The patent system, as constituted in all countries where it is established, is a monopoly—an outrage on liberty and industry. It has consequences that are disastrous, seeing there are cases where it may stop business operations for exportation and even for home consumption, because it places manufacturers who work in a country were patents are established at a great disadvantage in competing with others who live in States, such as Switzerland, where patents are interdicted by law. Pratice, experience, which is the supreme authority in the world shows daily, in France particularly, that the system is a scourge on industry. What might be substituted is a system of recompenses, either national or European, as you have proposed, to be awarded when practical use has pronounced on the merit of each invention, and when the originality shall admit of being established. All the friends of industrial and social progress ought to unite their efforts to liberate industry from the shackles that have been bequeathed from the past. That of patents is one of those which there will be most urgency to get rid of.—Believe me, MICHEL CHEVALIER.

Rear-Admiral F. Bullock has been making a series of experimental trials on board the paddle-wheel steamer "Vivid," Commander W. H. Allen, which

has been placed at his disposal by the Admiralty, at the measured mile, Maplin Sands, near Chatham, for the purpose of enabling him to form correct tables and lay down a code of rules and regulations for the use of his newly-invented permanent ship-log, which is about to be introduced into the service. The Lords of the Admiralty are so well satisfied of the importance of the invention, that orders have been received at Chatham for the new log to be fitted on board the "Liverpool," 39, 600-horse power, Captain R. Lambert, belonging to the Channel squadron; and also the paddle-wheel steamer "Geyser," 6, 280-horse power, Commander M. R. Pechell.

Lately, a small paddle-boat has been plying on the Humber at a rapid rate. We understand it is worked by the pendulum, instead of oars, and it is the invention of a gentleman who is well known in London and Hull for his numerous inventions. It is also applicable to drive carriages on the high roads, and if constructed for the rail would go at the rate of 20 miles the hour. A carriage holding two gentlemen has several times been driving about Hull, then working its way to Beverley, and over the Ferriby Hills. It is the intention of the patentee to propel ships and life-boats by the pendulum, which may be applied to either screw or paddle. The apparatus is fixed in the boat, and is ready for use at any moment. In case of emergency this system must be of admirable service. The boat, which is a ship's jolly-boat, was tried from Hull to Paull, with four workers, and ran the distance in 27 minutes. The same distance a six-oared race-boat takes at least 25 minutes, the men pulling at the top of their strength. Whilst in the pendulum boat not a coat was taken off. Were the apparatus transferred from the jolly-boat to the race-boat, the inventor asserts that the same distance would be run in 15 minutes. The pendulum boat can be worked with half the ease of an oared boat, and any one unaccustomed to pulling can work the pendulum in two minutes, and continue to do so for 20 or 30 miles without fatigue. Any common boat can be fitted with the apparatus. The York papers state that the inventor intends making further experiments on or about the 23rd inst. on the Humber.

An ingenious Frenchman has discovered a most economical way of lighting cities, and proposes to apply it to Paris. Balloons, from the cars of which are to emanate an electric light, are to be fixed at certain stations, and hover over the city, at the proportion of one balloon to 80,000 persons; the city would be lighter at night than it often is in winter by day.

Experiments are being made in France with a new kind of rocket, which is to prevent the enemy from working at night. Besides giving a most brilliant light, illuminating a distance of 200 metres when let off, it offers the additional advantage of finally bursting like a howitzer, and carrying wholesale destruction into the hostile camp.

A scientific expedition, led by the eminent north country naturalist, the Rev. H. B. Tristram, of Greatham, is on his way to Syria. The members will employ themselves several months in exploring the zoology, botany, and geology of that interesting land.

The trial of Mr. Lynall Thomas's 9-in. muzzle-loading gun, carrying a 300-lb. shot, took place at Shoeburyness on Friday. The results were somewhat unsatisfactory. Ten rounds were fired, and the result is that at 2 deg. elevation the difference in the range is 164 yards; at 5 deg., 278 yards; and at 10 deg., 437 yards—all large numbers compared with those obtained in experiments with other rifled guns at similar elevations. The difference in the velocities is also large, being 142 ft. per second. It is just, however, to state that Mr. Thomas ascribes these results to the excessive length of the shot, and the finishing of the ribs too abruptly where they join the chamber of the gun, though *per contra* it is stated that the guns and shot have been manufactured under his own direction, and his objections should have been taken earlier. Mr. Thomas also complains that the powder was not rammed home, but it is stated that the difference of a few inches in the ramming home does not cause material deviations in other rifled guns, and that this is a defect in Mr. Thomas's.

The handsome new iron ship "Imperatrice Eugenie," built by Messrs. Scott and Co., Cartsdyke, for an Aberdeen firm, arrived at Natal on the 2nd ult., from London, in 58 days, and from the Land's End in 54 days—an almost unprecedented passage.

The French iron-clad squadron is expected at Cherbourg in about a week. It has experienced comparatively fine weather, and this time the members of the commission have not been prostrated by the *mal de mer*. The accounts that have reached us do not agree with those previously published by the *France*; the "Solferino," we understand, has come to grief, and will have to be towed home, having broken two blades of her screw. All the ships will require to be docked. If this be true, we leave our readers to decide whether these iron monsters can be considered good sea boats.

The many schemes of the day for the development of this, that, and the other, have caused some persons interested both for the district, and also of a patriotic disposition—though credit is not asked for the latter—to draw attention to the resources of Dartmoor. This place, it is said, has an area of 80,000 acres, and contains an almost inexhaustible supply of excellent granite, millions of tons of peat, and many thousand acres of good grass land. Tin is to be raised from almost all parts of the moor. The great want is a means of cheap locomotion by which the granite and peat, a valuable substitute for coal, may be transported to the surrounding districts. A great quantity of vegetables also could be raised there, as has been abundantly proved, and there would be formed a working population. Here is a chance for a dozen more new companies.

On Wednesday forenoon two large vessels built of steel were launched from the building-yard of Messrs. Jones, Queggan, and Co., at Liverpool. One was a sailing-ship named the "Formby," of 1,271 tons tonnage, built for the East India trade; the other a paddle-wheel steamer named the "Hope," of 1,492 tons. At a *dejeuner* which took place after the launch, Mr. Jones made some remarks on these vessels. He said that steel is much stronger than iron, weight for weight, and, consequently in shipbuilding, that equal strength can be given with less weight of steel than of iron. The strain resisted by iron-built ships had been found to be from 19 tons to 20 tons per square inch, while the resistance of steel is found to range from 42 tons to 48 tons, giving a mean of 45 tons for steel, or considerably more than double that of iron. Keeping these results in view, the "Formby," a vessel built of steel, required 500 tons of material in her hull, while a similar ship made of iron would have required 800 tons. The difference in weight of hull would cause a difference of nearly 2 ft. in displacement in favour of the steel vessel, requiring also less propelling power. In the case of steamers, the advantages were still more obviously in favour of steel. If the "Persia," a steamer of 3,600 tons and 900-horse power, had been built of steel instead of iron, her displacement would have been diminished about one-sixth, and she would have been enabled to carry double her present cargo. Mr. J. Reed, the Chief Constructor in the Royal Navy, who was present, said he should watch with great interest the career of the two ships which had just been launched. He remarked that merchant ships can be built to test a principle when war-ships cannot, as the former can be examined and repaired annually, while the latter are sent abroad for periods of three or four years. He perfectly agreed with what had been said of the importance of steel for the construction of small ships, and stated that the Government took great interest in the question of employing steel as a material for shipbuilding.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES, 966, 972, 1006.
BUILDINGS AND BUILDING MATERIALS, 1011, 1015.
CHEMISTRY AND PHOTOGRAPHY, 967, 1012.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 962, 971, 976, 995, 1001.
ELECTRICAL APPARATUS, 963.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 961, 965, 970 973, 980, 992, 996, 999, 1005, 1013.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 964.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 959, 1002, 1014, 1017.
GENERAL MACHINERY, 960, 974, 987, 989, 994, 997, 1016.
LIGHTING, HEATING, AND VENTILATING, 983.
METALS, including apparatus for their manufacture, 993, 1008.
MISCELLANEOUS, 968, 969, 977, 982, 985, 986, 988, 998, 1000, 1004, 1010.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 975, 984, 991, 1003, 1007, 1009.
SHIPS AND BOATS, including their fittings—*none*.
STEAM ENGINES, &c., 978, 979, 981, 990, 1018.
WARFARE, 958.

958. S. MOULTON. *Improvements in apparatus or means for lessening the recoil of cannon.* Dated April 16, 1863.

One part of this invention consists in the application of a break to the wheels or axle of the gun carriage. The particular construction of break which the patentee prefers to employ for this purpose, although he does not confine himself thereto, consists of a central shaft passing through the cheeks of the gun carriage, to which is attached a lever acting upon two clamps (or other form of friction surface) which clutch a drum or roller fixed to each axle of the carriage wheels, the pressure of the clamps being tempered by the action of india rubber or other suitable draw springs. Another part of the invention consists in attaching an elastic ring or rings of india rubber within an iron or other metal ring, by preference of oblong form, fixed to each end of the hawser of a ship's gun, at the parts where such hawser is fastened to the ship's side or deck, and to the side of the gun carriage. *Patent abandoned.*

959. W. OLDFIELD. *Improvements in the construction of locks, applicable for despatch and other boxes, writing and dressing cases, or other similar receptacles.* Dated April 16, 1863.

This invention consists in so constructing and arranging the parts of a lock that the lock and bolt may be applied to and carried by the upper part or cover of a despatch box, or of a writing or dressing case, or other similar receptacle, the key being introduced through a keyhole formed in the upper surface or lid of the box or case. The locking plate or catch is fixed on the lower portion of the box or case, by which arrangement despatch boxes, writing, dressing, or other folding-cases can be unlocked, and readily opened out without reversing their position after being unlocked, as is the case when the locks are applied to the lower portion of such articles. *Patent completed.*

960. A. SAMUELSON. *Improvements in the construction and arrangement of machinery and apparatus for the manufacture of oil.* Dated April 16, 1863.

This invention relates to a peculiar arrangement of machinery and apparatus for the manufacture of oil, and particularly intended for use in the colonies and in foreign countries, and consists in so arranging and disposing the various parts as that all the shafting required, in place of being attached to the building containing the mills, is attached to or forms part of an independent framing, forming part of the machinery itself, so that no separate fitting or attachment is required for such shafting, and the same is quite independent of the buildings, the advantages attained being that the fitting or fixing abroad by skilled workmen is dispensed with, and the whole of the machinery being compact is easy of export and removal. *Patent completed.*

961. T. A. W. CLARKE. *An improved construction of shuttle driver, and apparatus for working the same.* Dated April 16, 1863.

This invention relates to a novel arrangement of parts for effecting the driving of shuttles, the object being to ensure the proper action of the shuttle. The driver is a sliding rod provided with teeth or projections for taking hold of the shuttles, and traversing them to and fro through the shed. These teeth are so situated on the rod that, while the one that engages with the shuttle for traversing it in one direction is operating, the other is out of action, and clear of the bearings in which the driver slides. They are brought alternately into position for working the shuttles by the rocking of the driver in its bearings. Fitted to the extremity of the driver is a rack which gears into a pinion operated by a crank arrangement to be presently described, and by this means the to-and-fro motion is given to the driver. A pin projecting from the driver takes into the slot in a fixed plate, and by descending an incline in that slot transmits the axial motion to the driver. *Patent abandoned.*

962. F. A. E. G. DE MASSAS. *Improvements in smut machines, and in machines for cleansing and peeling grain and seeds.* Dated April 16, 1863.

In this improved machine a drum having a rough surface, and capable of rotary motion, is fitted within a slightly inclined fixed casing, having on its inner surface three sets of brushes of graduated strength or hardness; the first or hardest set consists of wires surrounded by or combined with bristles, each cluster of wires having a cluster or number of bristles round it; the next or softer set is of French whisks, or other fibre; and the third or softest set is of cocoa-nut fibre, or other fibre softer than the second set. Between the second and third set is a surface of wire gauze. The inventor mostly has this arrangement of brushes of wire gauze on the lower portion of the inner surface of the casing, while on the upper portion thereof is only a set of brushes of the first description (wire and bristle) combined with or having next to it a wire gauze surface. *Patent abandoned.*

963. R. KNIGHT. *Improvements in treating and preparing iron, copper, and other wires, for telegraphic and other uses, for the purpose of preserving them from corrosion or decay.* Dated April 17, 1863.

The patentee claims treating and preparing iron, copper, and other wires for telegraphic and other uses by coating such wires with pure tin, and condensing the same thereon by any suitable mechanical means, as described, for the purpose of compressing or condensing the c[illegible] f tin when applied on the surface of metallic wire [illegible]

completely close up the pores of the tin as to prevent the coated wire from being chemically acted upon by acid or other solutions, or from the oxygen of the atmosphere, or from other atmospheric, gaseous, aqueous, or submarine influences. *Patent completed.*

964. S. RILEY. *Improvements in the manufacture or preparation of cocoa and chocolate.* Dated April 17, 1863.

This invention consists in the application (as a compound for commercial purposes) of coffee, or its extract or essence, with cocoa, its essence or extract, or its husks, all or singular; also in the application of such combination or combinations with taraxacum, chicory, or calcined sugar, their essences or extracts, all or singular, which compound may be prepared by the mixing of coffee and cocoa, or the husks of cocoa, with taraxacum or chicory, or calcined sugar, in various proportions; or it may be prepared by the mixing various proportions of all the said articles. *Patent abandoned.*

965. J. RICHMOND, T. RICHMOND and D. HARLING. *Certain improvements in looms for weaving.* Dated April 17, 1863.

This invention consists in a novel arrangement and combination (which we cannot here describe in detail) of apparatus for regulating the tension and delivery of yarn from the warp beam during the process of weaving. *Patent abandoned.*

966. J. GOUCHER. *Improvements in steam boilers, and in regulating the admission of air into furnaces of steam boilers.* Dated April 17, 1863.

These improvements in steam boilers consist in making the boilers conical or tapered in the direction of their length, and with or without a fire-box. The boilers are formed of two conical tubes or cases, one tube being placed within the other. Or a series of tubes are placed within a conical or tapered case. In some cases the patentee adds a third tube, by which the steam may be superheated; or this tube may be made open at the ends, and constitute a water space at pleasure. The invention also consists in placing round the chimney a water cistern for heating the water both with the spent heat and the exhaust steam which passes through a coil or straight pipe; the cistern being kept only two-thirds full, so much of the steam as is not condensed will pass off at an outlet at the top of the chimney and thereby increase the draught. *Patent completed.*

967. R. C. CLAPHAM. *Treating the waste liquors from bleaching powder stills in order to obtain hydrochloric acid and other products therefrom.* Dated April 17, 1863.

The waste liquors above named, which usually contain about one-third of the hydrochloric acid used in the manufacture of bleaching powder, and in an uncombined form, are conducted into a furnace made of brickwork or other suitable material, with heat directly or indirectly applied, as in a blind furnace; or the solutions aforesaid may be distilled in suitable retorts. In either case, the patentee passes the vapours or gases—which consist of hydrochloric acid and steam—through pipes which may be cooled by water, or by the air, or otherwise. Or he passes the gases or vapours through condensers in the usual manner, as well known to manufacturers, and he obtains hydrochloric acid, which generally averages about 15 deg. Twaddle. The acid so obtained is applied in the place of water for muriatic acid condensers, according to the plan recommended for the use of weak muriatic acids in a previous patent of the patentees, dated 11th September, 1860, and by this means he obtains commercial muriatic acid, suitable for the manufacture of bleaching powder, or for other purposes. Or he adds ground manganese to the solution in the furnaces or retorts above described, and after heating a suitable time he obtains chlorine, which may be applied in the manufacture of bleaching powder. The residue left in the furnace or retort consists of chlorides of manganese and iron, and may be variously applied. *Patent completed.*

968. R. H. LAWSON and W. DARLOW. *Improvements in apparatus or means for obtaining motive power.* Dated April 17, 1863.

According to one method of carrying out this invention, the inventors take a box or receptacle of cylindrical form, of about six times the diameter as to length, such box being divided in the centre by a partition, and having the ends made tight by covers. The box is suspended from the centre by suitable pivots, upon which it partially rotates, as required. The pivots are carried by a framing attached to the ground or other foundation, as may be suitable. This tube or box has two holes in it, which are partially closed by two balls or ball valves, and two air-holes are also arranged in the opposite ends of the two divisions. On the top of the tube or box two other tubes or boxes are placed, which the inventors prefer to make about one-fourth of the diameter of the large tube or box; these are fixed on the tube at an angle of about 5 deg. more or less, and they are in length about four and a half times the diameter of the large tube or box; they are fixed so that one end of each tube is directly over and connected with the larger orifice in the box, while the other end of each tube projects beyond the end of each partition or portion into which the tube or box is divided. The end of the box or tube opposite to that where the upper tubes overhang is furnished with a rod or bar of about one and a half times the diameter of the tube or box in length, to which a weight is attached as required. The two upper tubes are open, or partially so, at the outer ends. These tubes are partly filled with a number of pieces or balls of iron, or partly of wood or other suitable substance and partly iron, two of which balls close or partially close the apertures in the tube or box before referred to. The apparatus above described is entirely filled as to the tube or box with mercury (by preference), and is then ready for use. The apparatus is pulled over on its pivots to a certain point by power being applied to the rod or bar attached to the end of the tube; the mercury then enters the small tubes by the apertures therein, and as it enters it causes the pieces of wood, iron, or other material to rise in the small tubes. When they have ascended sufficiently high, the weight of the balls or other pieces of iron causes the tube or box to lose its inclined position, and return to its original horizontal position; on its arrival at such position the mercury in the small tubes runs out into the large box or tube, and is thus made ready for another lifting or tilting operation. These are continued at regular intervals, and the power so obtained may be readily transmitted in any convenient manner, as is well understood. *Patent abandoned.*

969. W. MASSINGHAM. *Improvements in apparatus for cooling liquids.* Dated April 17, 1863.

For the purposes of this invention a rotating fan, mounted on a vertical axis, is employed in order to put the air in motion above the liquids which are contained in a suitable open vessel. The fan carries hollow channels in the form of tubes, or otherwise, which are caused to revolve with the face above the liquids. The forward end of each hollow channel is inclined downwards, so that its forward point or end comes just below the liquids; hence, as the channels revolve, the liquids ascend the inclined ends of the channels, and flow along the same till they arrive at the outlet ends, which it is preferred should be so formed by being perforated or otherwise as to divide the liquids into numerous streams. The forward end of each of the channels is also provided with a bell-mouthed entrance above the inclined parts, by which currents of air are caused to pass along with the liquids through the channels. *Patent abandoned.*

970. C. TURNER. *Improvements in the manufacture of felted fibres.* Dated April 17, 1863.

Heretofore, in the manufacture of felted fabrics, in order to strengthen the fabric and prevent it stretching, threads have been laid in transversely from side to side of the batt. This invention consists in an improved method of laying in these threads. The threads to be laid in are drawn from a frame of bobbins placed at one side of an endless apron on which the batt is carried; the threads pass down from their bobbins through a reed placed parallel with the endless apron, and this reed keeps the threads equally spaced. After passing through the reed, the threads enter a holder, which retains their ends. The holder employed is a comb with teeth set closely together; it is fixed close up to the edge of the endless apron. The threads are taken across the batt by means of a carrier. The carrier employed is a moving comb similar to the holder or fixed comb. The carrier rises up in the space between the reed and the holder comb, and it thus takes the threads as it rises; it lifts the ends of the threads out of the holding comb, and then moving away from the reed and across the endless apron it carries the threads over the batt. The carrier comb then again ascends, and leaves the threads. On each side of the endless apron there is a row of points, which retains the threads in the positions in which they are laid. Between the endless apron and the holder comb there is a knife; it may be an endless band of steel sharpened on the edge, or a rotary knife, and thus cuts off the threads which have been laid across the batt from the bobbins. The operation is continued by the carrier comb returning under the endless apron, and again taking the threads as before. By the time it makes another traverse over the batt, the endless apron with the batt upon it will have travelled a distance equal to the width of the carrier comb, so that the threads will be laid on a portion of the batt immediately succeeding that which received the yarns at the previous traverse. *Patent completed.*

971. B. J. WEBBER. *Improvements in apparatus for separating corn from the ears, and for combing straw.* Dated April 17, 1863.

For the purposes of this invention a platform is used which is arranged to move on axes or pivots at its front edge. At the back edge it is provided with projecting spikes or teeth, the back ends or points of which come nearly to a beating drum or cylinder. On and around the circumference of this drum or cylinder are set rows of teeth or spikes corresponding in length with those on the platform. The spikes or teeth on the drum, as they rotate, pass between the teeth of the platform. The platform is arranged in two parts, so that one man may be causing the straw to be combed, and the grain to be removed from the ears of one bundle or quantity of straw, whilst another man is causing the other end of another bundle of straw to be combed so as to produce reed. The spikes or teeth on the drum or cylinder do not radiate from the centre but incline downwards. The two parts of the platform are each arranged in such manner that its end or edge next the drum or cylinder may be raised and lowered by the foot of the workman. The bundle or quantity of the straw is placed on the platform with the ears towards the cylinder or drum, when the end of the platform next the drum or cylinder is at its highest position, and the workman gradually allows the platform to descend, by which the grain will be removed from the ears, and that end of the bundle or quantity of straw will be combed out. The workman will then reverse the end of the bundle or quantity of straw, and move it on to an intermediate platform, from which the other workman will remove it into the position to have the butt end of the bundle or quantity similarly combed or treated. It will be evident that single machines may be used, and both ends of a bundle or quantity of straw be combed out at the same place. Rotary motion is communicated to the drum or cylinder in any convenient manner by horse power or otherwise. The teeth or spikes of the drum are cleansed of the combings by a revolving axis with teeth. The grain thrashed or removed from the ears is received on to a riddle in the ordinary manner of thrashing machines. *Patent completed.*

972. C. W. and F. SIEMENS. *Improvements in furnaces which are principally applicable to the smelting of iron.* Dated April 18, 1863.

This invention consists in treating coal or other carbonaceous matter for its conversion into coke and combustible gases, either for heating or for illuminating purposes, by means of furnaces of such peculiar construction that, not only is the separation of the gaseous from the solid or carbonaceous constituents of the coal, and in some cases the subsequent total conversion of its carbonaceous constituents into combustible gases, effected in a continuous manner without losing either the combustible gases evolved or the heat residing in the coke while in a state of incandescence, but also the separation of the gaseous constituents, effected with such uniformity, and at such constant temperature that the coal or other material operated upon is converted into gases of considerable heating and illuminating powers, and into coke of superior quality and value to that produced in the ordinary gas retort or breeze ovens; in addition to which substances, such as lignite, peat, and poor coal, may also be made available for the production of comparatively rich combustible or illuminating gases. The invention also consists in so arranging the apparatus that those gases and vapours which are usually formed when the process of distillation is carried on at the temperature heretofore employed, such as light carburetted hydrogen and olefiant gas, the vapours of tar, ammonia, carbonic acid, and others, become decomposed and re-formed under the influence of a white heat into another class of carburetted hydrogens of greater value for illuminating and heating purposes, such as acetylene, propylene, and analogous compounds. *Patent completed.*

973. W. S. MACDONALD. *Improvements in apparatus for drying animal, vegetable, and mineral substances.* Dated April 18, 1863.

This invention consists in drying silk, wool, cotton, hemp, flax, jute, grass, fibre, or leaf, whether in the raw or manufactured state, and minerals or their products, either raw or manufactured, by means of one or more revolving endless or continuous aprons or lappings, between which the substances to be dried are placed, and along with which they pass round a stationary or revolving cylinder or cylinders, heated with steam or otherwise, or over heated steam chests, which endless or continuous aprons or lappings may be made of any material suitable for the quality and condition of the substances to be dried. The aprons or lappings pass over guiding rollers, which, if necessary, may be kept to the proper breadth by pitch chains and tenter teeth or hooks, or any other equivalent methods, to keep the said endless or continuous aprons or lappings distended. *Patent abandoned.*

974. T. A. WESTON. *Improvements in ratchet levers.* Dated April 18, 1863.

In carrying out this invention, large and strong teeth are employed in the ratchet wheels of the said ratchet levers, and the same nicety of adjustment obtained which is usually obtained by fine teeth. *Patent completed.*

975. W. B. BURDEN. *Improvements in wheels and axles, applicable to locomotives, carriages, and paddle wheels.* Dated Aprill 18, 1863.

In carrying out this invention, the inventor proposes to form the arms of the axles of carriage wheels or of other axles whereon the wheels revolve in such manner that they shall be horizontally at right angles to the centre line of the carriage fore and aft, or to the line of progress, the same being vertically declined to the extent, by preference, of 17 degs. and three-fifths, or thereabouts, or not less than 9, nor more than 25 degs. The wheels are to be so constructed that, as they revolve on level ground, each spoke or the medium line of the spokes shall be vertical notwithstanding the vertical declination of the axle, so as to have an upright bearing under the axle, the tyres if flat being horizontal on the ground, but they may be convex or of other sectional form. For locomotives, or for railway carriages where the wheels revolve fixed or keyed on their axles so that their axles revolve with them, the faces of the wheels are to be horizontal on the rail, the centre line of each axle being vertically declined as before described, the bearing of the spokes between the tyres and the axles being upright, whether the faces of the wheels are horizontal or otherwise on level rails. *Patent abandoned.*

976. G. A. BUCHHOLTZ. *Improvements in apparatus for hulling grain, and for reducing granular substances.* Dated April 18, 1863.

This invention has reference to a previous patent, dated Nov. 19, 1862 (No. 3,113). The first part of the present invention relates to an improvement in the hulling machine, and consists in making it of a hollow conical case, which is provided at certain parts throughout its length with converging blades of iron or steel. These blades are set on edge, and are spaced out by thin filling pieces of paper, cardboard, or thin wood, and are arranged longitudinally in the case, so as to present their cutting edges to the grain to be hulled. The best result is obtainable by fitting a portion only of the inner surface of this conical case with these converging blades, the other portions of the case being made up of wire gauze, or perforated metal, which will act as a sieve for the bran or skin that is removed from the grain by the action of the steel blades thereon to fall through. When this case is fitted, a conical runner, provided at its periphery with longitudinal steel blades, is set radially around the runner. The conical runner is made of considerably less length than the case in which it is placed, to allow of its being moved up longitudinally therein into the more contracted portion of the case as the blades are worn away, and the diameter of the runner consequently decreases. In order to break down the hulled grain so as to prepare it for the operation which reduces it to the form of semolina, the patentee proposes, instead of using the crushing rollers described in the specification of the former patent above referred to, to groove one roller longitudinally and the other transversely. This improvement relates to the reducing machine, whereby the hulled and crushed grain is reduced to semolina. It may be described as a vertical conical mill, the cutting surfaces of which are furnished, like the hulling machine already described, with iron or steel blades spaced out by strips of cardboard, paper, or thin wood placed between them. *Patent completed.*

977. T. HUNT. *Improved apparatus for obtaining motive power.* Dated April 18, 1863.

In carrying out this invention, the inventor provides a cylinder, which he mounts on trunnions like the cylinder of

an oscillating engine, and within the cylinder and at the opposite ends thereof he applies two pistons, which he connects together by a parallel motion; or he otherwise arranges them so that the pressure put on the face of the one piston will have a tendency to give a lateral motion to the other piston. The ends of the cylinder he closes in the usual way, and conveys water or other fluid under pressure into the space between the outer face of the pistons and the cylinder ends. This pressure, by being simultaneously applied to the two pistons, will cause them to press edgewise against the opposite sides of the cylinder, and thereby convey rotary motion thereto. *Patent abandoned.*

978. P. G. ROWELL and H. HOLT. *A better and more economical mode of securing the bands of locomotive engine and tender springs, also a new method of applying the same.* Dated April 20, 1863.

Heretofore, the above-named springs, and the leaves composing them, have been much damaged from the bands being driven on hot, and quenched to fix them in their places, and very frequently the leaves break when in action from the unequal pressure upon them. According to this invention, they will not be liable to damage, the bands being put on and fixed cold, and the leaves of the said springs will have india rubber, leather, or other suitable substance placed between them, thus equalizing their pressure one on the other, and also from their being drawn tight they will not get displaced when in action. *Patent completed.*

979. C. RANDOLPH and J. ELDER. *Improvements in surface condensers.* Dated April 20, 1863.

This invention relates to surface condensers of the kind having a series of tubes in a casing, and comprises improved means of holding the tubes in the tube plates. In carrying out this invention, according to one modification, short tubes or ferules are fixed in the tube plate, so as to project a little on the outer side, and the condenser tubes are passed through these fixed tubes, being made of such a length as to project a little beyond their outer ends. There is then passed on the end of each condenser tube and fixed tube a short tube of an elastic material, such as vulcanized rubber, which grasps both and makes a water-tight joint, without hindering the slight movements caused by the expansion and contraction of the metal. *Patent abandoned.*

980. G., W., and J. GRAHAM. *Improvements in machinery for folding or plaiting fabrics.* Dated April 20, 1863.

This invention relates to a new or improved machine for folding or plaiting silk, cotton, woollen, linen, or other woven fabrics into straight, even, and equal folds of from 12 in. to 2 yards, or more if required. Instead of a horizontal or curved table, the inventors use a vertical frame or bar, or a series of frames or bars, supported in bearings at each end of the machine, or from the floor or otherwise, on the upper edge of which the cloth is laid, an equal length of cloth being made to fall down on each side of the frame or bar by means of a vibrating cage working in the arc of the circle over the vertical frame or bar, or upon horizontal guide bars. A footboard, friction bars, handles for starting and stopping, strap guide and bar rods, break wheel, brushes, sloping board, and guide rod, with sliding collars, adjustable by set screws, or other convenient arrangement, may be used as in the present ordinary plaiting machines. *Patent abandoned.*

981. C. BLANC. *Improvements in apparatus for the purpose of using air and steam as motive power.* Dated April 20, 1863.

This invention relates to apparatus having for its object to combine the elastic forces of the atmospheric air and steam, so as to obtain thereby increase of power with economy of fuel and water. As arranged by the patentee, the apparatus is provided with small double-acting pumps, of which there may be one or more in connection with the upper portion of the apparatus, and a corresponding number in connection with the lower portion of the apparatus. The pump or pumps in connection with the upper portion of the apparatus are for the purpose of forcing atmospheric air into such apparatus, partially to condense the exhaust steam conducted therein by a suitable pipe or passage from the cylinder of the engine with which such apparatus is in connection. The pump or pumps in connection with the lower part of the apparatus serve to draw therefrom the partially condensed steam and atmospheric air, and force them into the boiler or generator through pipes suitably arranged for that purpose. These pumps may be worked by the engine with which they are used. *Patent* fluids will continually flow, separated from the matters with which they are previously mixed or combined. When the more solid matters fill, or for the most part fill, the first compartment, they are to be removed therefrom, and such matters will be found to be arranged within such compartment in the order of their specific gravities; thus, by this apparatus, in those cases where the liquids are such as will become clear by subsidence, such liquids will be separated in a clear or more or less clear state, whilst the matters heavier and lighter than the fluids with which they were previously mixed or combined will be retained back separated from the fluids. *Patent abandoned.*

983. W. E. NEWTON. *Improvements in lamps.* (A communication.) Dated April 20, 1863.

This invention is not described apart from the drawings. *Patent completed.*

984. E. W. HUGHES. *Improvements in turn-tables, turn-bridges, and slips.* Dated April 20, 1863.

This invention is not described apart from the drawings. *Patent completed.*

985. A. FORD and R. RIGG. *An improved method of re-forming and re-using old or waste vulcanized india rubber.* Dated April 21, 1863.

The patentees claims—1, the preparing of vulcanized india rubber, when in a state of fine division, and without any previous annealing or amalgamating, in moulds for the purpose of its being subsequently submitted to the action of heat; 2, the re-moulding and re-vulcanizing india rubber without the aid or necessary admixture of any of the new or unvulcanized india rubber. *Patent completed.*

986. H. RAFTEN. *An improved process for obtaining printing surfaces.* Dated April 21, 1863.

This process for obtaining printing surfaces is founded on the elasticity of a sheet or film of india rubber, or similar elastic gum or substance, which is made in certain parts to adhere to a plate or sheet of a porous, permeable, or pervious and comparatively non-elastic material, or some non-elastic material that is made permeable or pervious in the parts not required to adhere. A fluid is then made to pass through this non-elastic plate or sheet, with a certain degree of pressure, which expands the elastic sheet or film in those parts not adhering. As long as the pressure is continued, these parts are found projecting in convex surfaces from the non-elastic plate or sheet, and the surface of the elastic sheet or film in this state being made conducting with a coat of plumbago, an electrotype can be taken which will be the printing surface required. *Patent completed.*

987. J. HEAP. *Improvements in adjustable wrenches for nuts, pipes, and pins.* Dated April 21, 1863.

The first of these improvements consists in constructing wrenches of a new form, the handle being made so as to be lengthened at pleasure, by which means an additional leverage or power can at all times be obtained, and which is of great importance when the instrument is to be applied to nuts, pins, or pipes of varying dimensions. The inventor effects this improvement by having the handle made of a hollow piece of round iron or pipe, which is screwed or tapped inside with a thread to correspond with the thread of the screw on the contrary end of the head or jaw of the instrument. The handle is made larger in circumference next the screw than the screw itself, by which means it operates as a flange and regulates the sliding box. Another part of the improvements consists in making the head or jaw of the instrument with a tail screw to work into the screw of the handle, the part next above the screw being made square or four-sided, on which is placed the slide box with a tongue or catch working on a pivot or centre pin fixed on a projection or nib on the upper side of the slide box, which is acted upon by a spring attached to the tongue or nib. The second improvements consist into constructing nut wrenches with a screw of solid metal, and with pivots at each end, which turn in bearings composed of two small plates let into grooves in the head of the key. *Patent abandoned.*

988. E. L. SIMPSON. *An improvement in waterproof compounds, and in fabrics prepared therewith.* Dated April 21, 1863.

This invention consists in producing a compound free from sulphur or sulphurous ingredients, which, when applied, will render the articles or fabrics to which it is applied impervious to air or water, and free from the offensive odour arising from sulphured or vulcanized goods. vessel, and consequent oscillating motions of the governor, have no influence on the position of the throttle valve. The invention consists, finally, in placing the rod which transmits the motion of the balls to the valve loosely on the top of the rising-and-falling rod, leaving the latter perfectly free to accommodate itself to the varying position of the vessel without disturbing its connection with the said rod. *Patent completed.*

991. J. W. NOTTINGHAM. *Improvements in two-wheeled vehicles.* Dated April 21, 1863.

According to this invention the width of the body of the vehicle is extended, the springs disposed within the limits of the breadth, and beneath it, whereby a more commodious vehicle is obtained. By widening the body more room is also obtained for entering and alighting from the vehicle. As a further improvement to facilitate the entering and alighting from a vehicle, the inventor makes the doors to occupy nearly the full width of the body; and in order to render them easy of movement, as also to occupy a convenient space when open, he makes each half or part of the door in two or more pieces, hinged together so that they may be folded or rolled, if necessary, the one piece on the other, or be folded and disposed between the wheel and the body. The fourth part of the improvements relates to the head, which, instead of being a fixture, as usual, he makes separate from the body, and mounts it thereon on a pivot at each side, so that it rises and falls somewhat in the manner of a folding carriage head; but in this case the head is rigid, similar to the head of an ordinary cab. *Patent abandoned.*

992. H., E., S., and J. YEADON. *Improved healds for weaving.* Dated April 21, 1863.

These improved healds are made of steel, iron, brass, zinc, or other suitable substance, such healds also termed eyelets consisting of bars, strips, or pieces. The said eyelets or healds are made with one, two, three, or more holes or orifices through the same, with any form of eye, whether circular, square, or otherwise, as may be desired. These healds or eyelet pieces are arranged in or on frames of cast iron, or other substance, their ends being secured on steel or other wires or rods, which are fastened and tightened by means of the threads on the ends of the said wires or rods, provided with nuts correspondingly threaded, and these healds or eyelets will facilitate the weaver in tying the threads with ease, and secure facility of passing of the threads of the warp. Instead of making the healds or eyelet-pieces in the manner before mentioned, they may be made with one of the ends of each placed between pieces of wood, or other suitable material, secured together, and thus fastening the healds or eyelet pieces in position by pitch or such like adhesive and cohesive material, holes being provided in the middle of the pieces. *Patent completed.*

993. H. DONALD. *Improvements in machinery or apparatus for bending or straightening metal plates.* Dated April 21, 1863.

The patentee claims—1, the general arrangement and construction of rolling mills or machines for bending or straightening metal plates essentially as described; 2, the introduction and use of an intermediate roller of small diameter between the upper roller and the two lower rollers on rolling machines of this class, and for the purposes described; 3, the forming of the rollers of such mills or machines with angular or V-shaped grooves as described. *Patent completed.*

994. W. E. NEWTON. *Improvements in wrenches.* (A communication.) Dated April 21, 1863.

This invention relates to the construction of improved self-acting wrenches for screwing and unscrewing nuts of any shape or dimensions, whether circular, square, hexagonal, or of other form, and for screwing and unscrewing gas pipes and other articles requiring such an operation. The improved wrench may be formed with two jaws, or with a double pair of jaws, which, if desired, may differ in size and strength. One of the jaws is fixed firmly, while the other, which is moveable, slides in a forked part of the fixed jaw. The pressure against the moveable jaw is exerted by means of a lever or arm, which turns on a pin fixed in the stationary jaw, and is connected to the moveable jaw by a link. By pulling forward the lever, the nut will be firmly gripped between the jaws. The pressure exerted will correspond with the amount of force applied for turning the main lever, and will increase if nuts of smaller size are gripped. *Patent completed.*

vertical links of a chain harrow, leaving at the same time a more clean and fine tilth. *Patent completed.*

996. W. CAMPION and G. WILSON. *Improvements in machinery or apparatus employed in the manufacture of looped fabrics.* Dated April 21, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

997. W. RYAN and W. DANIEL. *Improvements in apparatus for transmitting, equalizing, and registering human power.* Dated April 21, 1863.

The power which this apparatus transmits may be used for driving pumps, grinding grain, and various other purposes for which motive power is required. The apparatus is especially suitable for use in prisons, and is so arranged that, if any one labourer of a number (set to work it) should cease working, he will not necessarily interrupt the others, nor even hinder them, except in so far as his cessation of work may reduce the amount of combined power, and such cessation of work will be at once signalled to his companions and to the person superintending. The framework of the apparatus forms a number of compartments or divisions, one for each man; they are so contrived that each labourer is separated from the others. In each division or compartment is a crank, one for each man to work; motive power is communicated by these cranks to a main shaft, which extends the whole length of the apparatus, and is common to and in connection with all the cranks. This shaft transmits the motive power which it receives to a pump, mill, or other engine, machine, or apparatus to be driven. The cranks communicate their power to the main shaft as follows:—Through each partition or division that forms the compartments is fitted a short shaft projecting at one end into one compartment, and at the other end into the adjoining compartment, so that two such short shafts project into each compartment, one at one side thereof, and one at the opposite side. Each short shaft has at one end a ratchet, and each crank has at the end of one of its arms a pall for driving such ratchet. The opposite end or arm of the crank works loosely on the end of the other short shaft—that is to say, each crank has on one arm a pall for engaging a ratchet and short shaft at one side, and its other works loose on a short shaft at the other side. On each short shaft is a toothed wheel in gear with a toothed wheel on the main shaft. It follows that when the labourers work the cranks, the palls will drive the ratchets, and these will actuate the toothed gearing, and thus communicate motion to the main shaft; but if one of the labourers should cease working while others are at work, the ratchet of his crank will travel over his idle pall, and produce a noise which will signalize the cessation of work in his compartment. The main shaft also actuates a registering apparatus placed at one end of such shaft; it is so fitted that the labourer cannot get at it to tamper with it. It gives notice when a certain quantity of work has been performed, so that when labourers are employed in relays, each relay may accomplish an equal quantity of work. This registering apparatus consists of a case in which are two endless screws, in gear with pinions or wheels so arranged that at certain intervals of time—that is to say, when a certain number of revolutions of the main shaft have been performed—they cause a bar, arm, or lever to strike a bell; or they may work an index pointer, or both work a pointer and strike a bell. *Patent completed.*

998. F. E. BRYANT. *Improved apparatus for ascertaining the temperature of steam and its power of tension.* (A communication.) Dated April 22, 1863.

This invention is not described apart from the drawings. *Patent completed.*

999. T. SETTLE. *Certain improvements in flyers to be employed in roving, slubbing, and spinning cotton and other fibrous substances.* Dated April 22, 1863.

This invention relates to a novel method of securing the flyers upon the spindles employed in machinery for roving, slubbing, and spinning cotton and other fibrous substances, and consists in forming a long vertical "key" or rib in a suitable position in the interior of the flyer tube in which the spindle fits, in contradistinction to the use of a short stud as hitherto employed, and which does not form a sufficiently perfect union between the spindle and flyer. The top of the spindle is grooved vertically into any required number of recesses, into which the said long "key" or rib falls, and so secures the flyer on the top of the spindle. The chief feature in the invention is the elongated form and position of the "key" by the lengthened bearing or surface of which a better and steadier hold is effected between the spindle and flyer. *Patent completed.*

1000. F. DURAND. *Improvements in moulding articles of china or other clay, or of other plastic materials.* Dated April 22, 1863.

This invention is not be described apart from the drawings. *Patent completed.*

1001. T. GRACE. *Improvements in reaping and mowing machines, part of which improvements is applicable to other useful purposes.* Dated April 22, 1863.

This invention consists—1, of a novel form and arrangement of apparatus for raking and delivering the cut corn (or grass) from the machine. On one end of the shaft of the travelling wheels there is a bevel wheel, which takes into a bevel pinion on a longitudinal shaft at one side of the platform of the machine. On this shaft there are three pulleys, connected by endless chains or belts with three corresponding pulleys on the opposite side of the platform. These endless chains, by means of suitable snugs, give motion to a cross piece, and cause it to traverse backward and forward from side to side of the machine. This cross piece carries with it three (or more) rakes or teeth, which are held in a vertical position whilst raking off the corn, but in the return movement they lie horizontally under the platform. By the alternating motion of the teeth or rakes the cut corn (or grass) is swept from the platform and delivered in a sheaf at the side of the machine. At the delivery side of the platform there are teeth to prevent the corn from being raked off until a sufficient quantity has been coll[illegible] form a sheaf. These teeth are held in a vertical position by a catch which is released by the action of the machine when a sufficient quantity of corn has been gathered. 2, In the use of a driving band for giving motion to the cutting knives. *Patent abandoned.*

1002. H. B. BARLOW. *Improvements in shoes, boots, and other coverings for the feet.* (A communication.) Dated April 22, 1863.

This invention consists in the application of a plate or plates of a peculiar form, made of malleable cast iron or other metal or material, to the toes of shoes, boots, and other coverings for the feet to render them more durable. The plates form a sheath or fender both for the protection of the upper and under leather at the toe of the boot, shoe, or other covering for the feet. The said sheath or fender is formed of compounded metals, and may be composed of a mixture of lead, tin, and bismuth, or any of the known metals or preparations, such as india rubber, gutta percha, or other substances which are sufficiently sequacious to be wrought or moulded into the desired form. The said sheath has a double form, being a union of the covering for the upper and under leather in one entire piece of metal or other substance of which it may be constructed. The form is such that it covers over the upper leather at the toe, and extends downwards over the outer sole, and passes over on the outer side of the said sole sufficient to receive the nails to fasten it on and has also a central flange which passes between the outer and inner sole extending back towards the heel. *Patent abandoned.*

1003. E. J. JEFFS and J. TURNER. *Improvements in the making and constructing carriage ways.* Dated April 22, 1863.

This invention consists in supporting the granite pitchers forming the surface of the road on sleepers, which may be of wood creosoted or otherwise, or of iron or wood combined, of any form, as may be thought most desirable, and of any suitable length, which sleepers may be laid longitudinally or diagonally; or there may be two layers of sleepers running at right angles to each other. *Patent abandoned.*

1004. W. CLARK. *Improvements in the means of obtaining publicity.* (A communication.) Dated April 23, 1863.

Provisional protection has not been allowed for this invention.

1005. J. LEE and E. DAWSON. *Improvements in looms for weaving.* Dated April 22, 1863.

The objects of this invention are—1, to hold out the cloth or fabric while in the act of weaving better than heretofore, and thus reduce the friction on the yarn or warp threads by the reed, and thereby prevent a great amount of breakage of yarn; 2, to keep the cloth or fabric in a straight line, and impart to the selvages a forward as well as an outward motion, so that they are kept tight, and thereby enabled to resist the drag of the weft which takes place when the shuttle is thrown from one side of the fabric to the other, by which means a more even selvage is obtained. The improvements consist in the employment of one or more screwed rollers, with right and left threads, either of the ordinary V-kind, or round-topped, and with single, double, or more threads, to present a greater or less angle to the cloth or fabric. The said screwed roller or rollers is or are placed in a suitable frame or frames, bolted or otherwise fastened to any convenient part of the loom, so that the screwed roller or rollers may be brought in contact with each side of the cloth or fabric, and driven by an intermittent motion, transmitted from any working part of the loom, through or by wheels, levers, springs, weights, chains, or any other suitable appliances which will drive the screwed roller or rollers at a greater speed than at which the cloth or fabric is made. The patentees also employ a roller or rollers covered with a soft yielding substance, such as india rubber, gutta percha, leather, or other suitable material, which roller or rollers is or are placed in the frame above mentioned, but on the opposite side of the fabric to that of the screwed roller or rollers, and acts or act to press the cloth against the screwed rollers to give them sufficient hold on the cloth to produce the outward and forward motion before mentioned. *Patent completed.*

1006. G. B. BARBER. *Improvements in steam boilers and apparatus connected therewith.* Dated April 22, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1007. J. W. PROFFITT and W. L. DUNCAN. *An improved mode and apparatus for distributing sand or any other suitable substance or substances on the rails of railways and tramways.* Dated April 23, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1008. J. WHITLEY, J. POPE, and J. W. BURTON. *Improvements in the manufacture of metals.* Dated April 23, 1863.

In carrying out this invention, the inventors generate steam from water mixed with hydro-carbon oils, and pass the vapours through charcoal at a red heat, which vapours they use in conjunction with the atmospheric air, or apart from it, in smelting or refining iron, copper, and other metals containing sulphur. *Patent abandoned.*

1009. R. RICHARDSON. *Improvements in railway permanent way.* Dated April 23, 1863.

This invention consists in new descriptions of railway sleepers, and a new method of fastening the rails on those sleepers. The sleepers are constructed of cast or wrought iron, or wood, or of any or all of those materials, in combination with cheeks, jaws, or chairs arranged in such manner that they receive keys placed on both sides of the rails alternately, or two or more on each side of the rails alternately, and by the assistance of those cheeks, jaws, or chairs on those sleepers the rails are held firmly in place throughout the line, including the joints of the rails, by a system of alternate keying. The improvements also consist in new cast or wrought-iron chairs or jaws to be attached to sleepers of such form that the rails are secured by alternate keying, as before described. *Patent completed.*

1010. W. E. NEWTON. *An improved mode of repairing worn-out files, and rendering them again fit for use.* (A communication.) Dated April 23, 1863.

This invention consists—1, in cleaning the file and removing from the surface in any convenient manner all organic, mineral, or other matter that may adhere thereto, and then placing the file in a bath of diluted sulphuric, nitric, or other corrosive acid, and allowing it to remain therein until the acid has bitten down into the metal and sharpened the teeth. When the teeth have been re-formed and brought to a point, the file must be taken out of the acid bath, washed in clean water, and then well brushed with pulverized charcoal or ashes, after which the file may be greased over in order to protect it from rust. *Patent completed.*

1011. W. CLARK. *Improvements in the manufacture of tiles; and in apparatus for the same.* (A communication.) Dated April 23, 1863.

This invention consists—1, of cylinders having circular grooves, and gearing one with the other, for cutting up and crushing the material to be used. 2, The apparatus is furnished with a pressing box and draw plate, which receives the material from the cylinders, and draws it out so as to form a cake or sheet, which is then hardened by pressure exerted by an eccentric receiving motion from a piston to which it is jointed. 3, The apparatus is furnished with a cast-iron mould for receiving the sheet of clay in order to form the tiles. This mould is placed in a press acting vertically, in which the sheet of clay receives an energetic pressure, which reduces it one-third of its thickness, and so causes it to take the exact form of the cast-iron mould. Tiles manufactured in this way are then trimmed round and exposed for a few days only to the air, in order to partially dry them, after which they are placed in ovens to be baked as in ordinary. *Patent completed.*

1012. T. RICHARDSON and J. C. STEVENSON. *Improvements in the manufacture of sulphate of soda.* Dated April 23, 1863.

In the manufacture of soda in alkali works, common salt and sulphuric acid are mixed together in a decomposing pan; but the salt is used at the ordinary temperature, and the sulphuric acid is generally heated before being mixed with the salt. This invention consists in heating the salt by any convenient method before mixing it with the acid. In order to prevent evaporation of the sulphuric acid, the temperature of the heated salt must not exceed the boiling point of the sulphuric acid employed. *Patent completed.*

1013. P. MCGREGOR. *Improvements in machinery for spinning and doubling.* Dated April 23, 1863.

This invention consists—1, in an improved arrangement and combination of machinery for effecting the second draw in mules; 2, in making the cam for throwing the rollers out and in gear in two pieces, whereby the working parts may varied in the relative positions at pleasure; 3, in an arrangement and combination of machinery for pulling the building faller-wire closer to the spindle-point as the cop gradually increases in length for diminishing the amount of backing-off in the set fills. In connection therewith the patentee makes the scroll for pulling down the faller the reverse way to that generally adopted. 4, in an arrangement and combination of machinery for throwing suddenly into gear the catch-wheel and catch, or the clutch box, for working the screw of the radial arm and raising the nut or point of attachment of the winding-on chain. 5, in an arrangement of machinery connected with the builder for throwing the catch boxes for driving the front drawing roller into gear, so that as the cop increases in length, the rollers are later in starting. 6, in a mode of attaching the winding-on chain to the radial arm, whereby a more beneficial action is produced on the winding-on as the cop increases in diameter. 7, when two scrolls are used for taking in the carriage, the patentee connects the bands of both scrolls to a double lever mounted on a stud attached to the carriage, so that both bands are kept at a uniform tension. And, lastly, in certain improved combinations and arrangements of self-acting machinery for tightening the winding-on chain, as the carriage goes in towards the beam. *Patent completed.*

1014. J. CAVANAH. *An improvement in cricket bats.* Dated April 24, 1863.

This invention consists in manufacturing a loose handle for cricket bats, and the joining of the same to the blade in conjunction with a spring. The loose handle is secured to the upper part or mouth of the blade of the bat by a hinge or knee joint; attached is a spiral or flat spring, made of steel, india rubber, or any other suitable elastic substance, fixed with metal plates and sockets to the blade and handle. The spring may be applied or attached to such portion of the blade or handle as may be found most desirable; its employment prevents the concussion of the ball stinging or jarring the hand. *Patent completed.*

1015. J. B. DAINES. *Improvements in the preparation of stone, plaster, compo, iron, wood, and such like substances, so as to preserve them from decay.* Dated April 24, 1863.

According to this invention, the patentee first prepares a solution by mixing together animal gall, liquor calcis, and liquor from boiling potatoes; these he prefers to mix in the following proportions—namely, one point of gall to one gallon of each of the other liquors. This solution he names solution No. 1. He next proposes a solution of sulphur and camphor, obtained by the use of a combination of mineral and linseed oils, or other suitable solvent compatible with the nature of the material under treatment; as, for instance, when stone or such like surfaces are to be treated with this composition, he prefers to use three parts by weight of linseed oil to one part by weight of purified mineral oil. When rough surfaces of iron, wood, stucco, and such like surfaces are under treatment, he prefers to use crude mineral oil together with a little of the lighter oil in order to reduce its consistency. In some

cases cheap fat oils may be used when they can be obtained; but in this case, as with the mineral oils, and sometimes with the linseed oils, to facilitate their drying quickly, it is necessary to use dryers, as is well known to painters. The quantity of sulphur is made to vary according to the purposes to which the compositions are to be applied. For saturating the surfaces of stone, the patentee prefers them to have in solution about one-sixteenth of their weight of sulphur; this is obtained by heating the oils with the flour of sulphur to the temperature of 278 deg. Fahr. When rough surfaces of iron, wood, stucco, and such like surfaces are under treatment, he prefers the compositions to contain a larger per-centage of sulphur than for the surfaces of stone. In these combinations the use of camphor varies considerably, depending upon the nature of the material to be treated, and the purposes to which it is to be applied; as, for instance, with wood and iron when exposed to damp or to dry-rot, he prefers these combinations to contain one-seventieth of their weight of camphor, and when not exposed to such actions, a smaller quantity may be employed. In certain cases he has found a small quantity of creosote to be advantageous where the camphor is used. The above solutions or compositions he names No. 2. The mode of treatment is as follows:—The surfaces of the stone, plaster, compo, wood, iron, and such like substances having been cleansed, when necessary by a solution of an alkali, and the alkali neutralized by a very weak acid, and thoroughly washed with water, he applies each of these solutions by the aid of a brush, in the same manner as painting, or by some such similar manner, to their surfaces; but, in the case of timber for ships, or other uses, statuary, and other portable articles, where it may be desirable to thoroughly saturate them, these solutions as required, No. 1 and No. 2, may be injected by means of an exhausted receiver. *Patent completed.*

1016. W. N. WILSON and J. G. GREY. *Improvements in machinery for sewing and stitching.* Dated April 24, 1863.

This invention relates to the combining of certain new and useful contrivances in what is technically termed the feed motion to those machines which are now in use, and which are adapted to what is called the four-feed motion machine. Instead of confining the four-feed motion to its up, forward, down, and backward motion only, to direct the cloth in a line at right angles with the body of the machine, and which feeds one way, the patentees use what is called a reverse movement attached to the said feed motion, which throws the feeding lever from the cams which actuate it for one direction, and brings it into contact with other cams, which actuate it for feeding in another direction, so that the up, forward, down, and backward motion of the feed is moved at right angles one from the other, thereby sewing lines of stitches at right angles to each other without turning round the cloth. *Patent completed.*

1017. J. LAMBERT. *Improvements in ball cocks.* Dated April 24, 1863.

This invention consists in constructing ball cocks as hereafter explained. The inventor makes the inlet and outlet passages lead into and out of a cylindrical chamber, the bottom of which forms the seat for a circular disc, under which a leather or other like suitable washer is placed. The disc is formed or fixed on the lower end of a spindle, which works through an aperture made in the cover of the chamber; a spring, by preference, in the form of a disc of vulcanized india rubber, is also fitted to the spindle inside the chamber, which balances the valve and prevents any liquid escaping through the top or upper part of the chamber. The rising of the ball or float on the long arm of the float-lever—the short arm of which is connected to the valve spindle—depresses the short arm, which forces the spindle down, and keeps the valve on its seat, so as to close all passage through the cock. Upon the ball or float falling, it raises the spindle and the valve off its seat, and opens up a way through the cock. *Patent abandoned.*

1018. J. SHEPPARD. *Improvements in steam engines.* Dated April 24, 1863.

According to this invention, an outer or fixed cylinder of a suitable diameter is employed, and in the interior thereof, and concentric with it, the inventor places another cylinder or drum of smaller diameter, capable of revolving, and keyed upon the shaft to be driven, the central line of which shaft passes through the axes of both cylinders, which are coincident with it, and with each other. To the face of the inner or revolving cylinder is fixed a piston plate, projecting in a radial direction therefrom, and fitting the space between the two cylinders. On opposite sides of the outer or fixed cylinder are two semi-cylindrical recesses of the same width as the cylinder (one upon each side), their radius being rather more than equal to the distance between the two cylinders, and their axes being parallel to the central shaft. Inside these recesses are placed semi-cylindrical or conical-formed blocks, mounted on shafts, and capable of revolving, being connected by cranks and spur wheels to the central shaft, so as to revolve at the same speed, but in an opposite direction to the other. The revolution of these crescent-formed blocks is so timed that each one presents its hollow face at the time the piston-plate is passing it; whilst the opposite one is revolving in contact with the inner cylinder, and acting as a steam-stop, the whole being made steam-tight by suitable packing. The valves are opened and closed so as to admit and cut off the steam at the required intervals by two eccentrics keyed upon the central shaft. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated August 24, 1863.

2093. L. Guillemot, 42, Rue du Moulin à Vent à Poitiers, Département de la Vienne, France. An improved machine for obtaining perpetual motion.

Dated September 25, 1863.

2362. C. de Wailly, No. 1A, Florence-street, Upper-street, Islington. An improved slipper or clog, principally intended for bath rooms.

Dated October 10, 1863.

2486. S. Banner, Liverpool, general broker. An improved mode or method of storing petroleum and other like oils and spirits.

Dated October 12, 1863.

2502. C. Humfrey, St. David's Works, Saltney. Improvements in the means and method of purifying hydrocarbons.

2504. G. Mountford, Brunswick-street, Leeds, manager. An improved construction of cotton gin.

Dated October 14, 1863.

2523. R. H. Smithett, King's Bench-walk, Temple, student-at-law. Improvements in the application of wheels to railway carriages.

Dated October 15, 1863.

2530. S. Flexen, 46, Skinner-street, Snow-hill. An improved apparatus for ventilating railway and other carriages, houses, buildings, steam and sailing vessels of all kinds, moveable or otherwise.

Dated October 17, 1863.

2543. Y. Meirat, Henry-street, Hampstead-road. Improvements in the means of propelling vessels.

Dated October 22, 1863.

2595. J. Craven and S. Fox, Leeds, engineers. Improvements in machinery or apparatus for punching, shearing, and burnishing.

Dated October 23, 1863.

2612. B. Marriott, 38, Upper-street, Islington, watchmaker. An improvement in watches, consisting in the construction of cylindrical dead beat independent centre seconds watches.

Dated October 27, 1863.

2650. J. C. Wilson, 14A, Cannon-street, civil and mechanical engineer. A new mode of mounting ordnance, and the machinery and apparatus composing the same, also the machinery and apparatus for working said ordnance, and for loading, cleaning, and counteracting the recoil when fired.

2652. E. G. Atherley, Orme-square, Bayswater, barrister-at-law. Obtaining motive power by certain arrangements of machinery and water.

Dated October 30, 1863.

2682. J. Haworth, 15, Hart-street, Bloomsbury, gentleman. Improvements in the improved method of conveying electric signals and telegrams without the intervention of any continuous artificial conductor.

2683. F. Durand, Paris, mechanical engineer. Improvements in cotton gins.

2690. B. Russ, Bristol, engineer. Improvements in the construction of iron and other ships, vessels, and batteries of war, and of cupolas and armour plates applicable thereto, parts of which improvements are also applicable to other useful purposes.

Dated October 31, 1863.

2698. A. Wasserburgen, 9, Calvert street, Shoreditch, merchant, and T. Bessunger, merchant. Improvements in the manufacture of show cards, window tickets, and ornamental labels as advertising mediums.

2699. S. H. Parkes, Birmingham, manufacturer. Improvements in opera glasses, telescopes, microscopes, spectacles, and other optical instruments.

2700. W. Tasker, Waterloo Iron Works, Upper Clatford, Southampton. Improvements in the making of safety paper, and in the machinery or apparatus employed therein.

2706. J. Wilson, Upper Poppleton, Yorkshire. Improvements in thrashing machines.

2707. S. Holman, 18, Cannon-street, City, engineer. Improvements in machinery for raising and forcing fluids, parts of which improvements are also applicable to steam engines, blast engines, exhausters, and other machines.

Dated November 2, 1863.

2710. F. J. Vandenvinne, 37, Rue aux Laines, Brussels, manufacturer. Improvements in machinery for excavating land, making cuttings, and other earthworks.

2712. T. F. Wintour, Clifton, near Bristol, esquire. Improvements in ventilators and fire-guards.

Dated November 3, 1863.

2713. T. W. Alderton, Ipswich, machinist. Improvements in sewing machines.

2714. F. J. Pastorelli, 208, Piccadilly, optician. Improvements in the construction of surveyors' levels and other surveying instruments.

2718. S. Bateman, Asnieres, France. Improvements in machinery for combing wool and other fibrous substances.

2720. J. J. Révy, 28, Grosvenor-street, Eaton-square, civil engineer. Improvements in the manufacture of explosive compounds.

2721. M. Henry, 84, Fleet-street. Improvements in the manufacture of zinc white. (A communication.)

Dated November 4, 1863.

2722. J. Livesey, 75, Cannon-street West, and J. Edwards, 29, Basinghall-street. Improvements in the permanent way of railways, and fastenings for the same.

2724. G. Ville, Paris, professor at the Museum of Natural History. Improvements in treating natural phosphates of lime for agricultural purposes.

2726. E. Hughes, Bagillt, Flint. Improvements in fans for forcing and exhausting air or other gases.

2727. C. Howe, jun., New York. Improvements in sewing machines.

2730. A. Gillett, Highway Farm, Berks, engineer. Improvements in machines for cutting chaff and such like substances.

2732. J. H. Maw, Broseley, Salop, gentleman. Improvements in the application of preservative coatings or compositions to the bottoms of ships and vessels.

Dated November 5, 1863.

2736. J. Northrop, Thornton, near Bradford, Yorkshire. An improved apparatus for making fringes.

2737. E. K. Dutton, Stretford, Chester, mechanical engineer. Certain improvements in apparatus for coating or covering the surfaces of rollers or cylinders with leather or other material.

2738. T. Farra, Manchester, salesman. Certain improvements in "skirtings" employed as wearing apparel.

2741. W. Proger, George-street, Middlesex, tin plate worker. Improvements in lanterns, and lamps for the same.

2742. H. Hancock, 28, Clayland's-road, Clapham-road, and W. H. Vickers, jun., 24, Blackman-street, Borough. A new system of fastening for doors, windows, safes, chests, and other similar purposes.

2743. J. Whitworth, Manchester. Improvements in the treatment and application of steel and homogeneous metal.

2744. H. Bessemer, Queen-street-place, New Cannon-street. Improvements in the manufacture of railway bars.

2745. S. Smith, Hyson Green Brass Works, near Nottingham. Improvements in safety valves for steam boilers, and in valves and taps for regulating the flow of fluids.

2746. H. Bessemer, Queen-street-place, New Cannon-street. Improvements in the manufacture of malleable iron and steel, and in the apparatus employed in such manufacture.

2747. R. T. Tait, 10, Essex-street, Strand. Improvements in the manufacture of woollen garments.

2748. G. Speight, 5, St. John-street-road, Clerkenwell, manufacturer. An improvement in collars and cuffs.

2749. F. E. Sickles, New York, engineer. An improved mode of, and apparatus for, steering and turning vessels.

Dated November 6, 1863.

2750. C. D. Abel, 20, Southampton-buildings, Chancery-lane. Improvements in fluid meters. (A communication.)

2751. C. Coates, Sunnyside, Lancashire, engineer. Certain improvements in machinery for printing cotton and other fabrics.

2753. J. Muckart, Letham-mill, near Arbroath. Improvements in preserving certain vegetable substances.

2754. W. Davies and G. Cate, both of 151, North-street, Old-road, Stepney, cork cutters. Improvements in machinery for cutting corks, bungs, gun wads, and other similar articles.

2755. C. H. Southall and R. Heap, Staleybridge, Lancashire. Improvements in self-acting machinery or apparatus worked by steam or other power, for cutting and shaping the soles and heels of boots and shoes, and screwing them on to the uppers or coverings, and also in vices for holding the same, and tools for paring, blacking, and glazing, or otherwise ornamenting the edges of the soles and heels.

2757. J. S. Guirette, Paris, doctor of medicine. An improved inhaling apparatus.

2758. J. Townsend, Glasgow, manufacturing chemist. Improvements in the manufacture of nitrate of potash.

2759. W. M. Neilson, Glasgow, engineer. Improvements in axle-boxes. (Partly a communication.)

2761. C. M. Campbell, Stoke-upon-Trent, esquire. Improvements in apparatus for drying plates and other articles of china and earthenware.

2762. W. H. Perkin, Seymour-villa, Sudbury. Improvements in the manufacture of colouring matters suitable for dyeing and printing.

2763. R. Johnson, Manchester, iron and wire manufacturer. Improvements in testing the strength of wire for telegraphic and other purposes.

Dated November 7, 1863.

2765. H. L. Emery, 72, Sloane-street, Chelsea, agricultural implement maker. Improvements in machinery for ginning and cleaning cotton, a part of which are applicable to machines for other purposes.

2766. T. C. Barraclough, Manchester, engineer. Certain improvements in looms for weaving. (A communication.)

2767. R. Batt, Waterhouse-mill, Milnthorpe, Westmoreland, paper manufacturer. Improved arrangements of paper-making machinery.

2769. J. Johnson, Peterborough, engineer. Improvements in apparatus for lubricating the cylinders and other parts of steam-engines.

2771. L. Braham, Hatton-garden, London, optician. Improvements in spectacles and hand-frames.

2772. W. Clark, 53, Chancery-lane, engineer. An improvement in sewing machines. (A communication.)

2773. G. S. Melland, Lime-street, City, gun manufacturer. Improvements in breech-loading firearms and ordnance. (A communication.)

2775. A. Barclay and A. Morton, engineers, Kilmarnock. Improvements in certain apparatus for injecting and ejecting fluids.

2778. M. Mellor, Nottingham, framesmith and machine builder. Improvements in machinery or apparatus for the manufacture of looped or knitted fabrics.

Dated November 9, 1863.

2781. H. Mège, 10, Rue de la Fidelité, Paris, professor of chemistry. Certain improvements in the manufacture of soap.

2782. W. J. Cunningham and H. Connop, Everett-terrace, Victoria Dock-road. Improvements in sawing machines.

2783. G. T. Bousfield, Loughborough-park, Brixton. Improvements in the construction of ships and vessels. (A communication.)

2784. N. Thompson, Abbey-gardens, St. John's-wood. Improvements in apparatus for stopping bottles and other vessels.

2785. G. Ryder, Church Gate Engine Works, and M. Gutteridge, East-street, Leicester. Improvements in hay-making machines.

Dated November 10, 1863.

2787. T. Weston, 5, Montague-street, Dublin. Improvements in printing presses.

2788. J. C. Habicht, 4, South-street, Finsbury, merchant. Certain improvements in keyless watches. (A communication.)

2789. G. Yates, Wolverhampton, mechanic. Improvements in machinery to be used in the manufacture of heel tips and toe tips, and toe plates for boots and shoes.

2790. J. Ramsbottom, Accrington, Lancashire, engineer. Improvements in machinery or apparatus for measuring and registering fluids, and in obtaining motive power from the same.

2791. S. J. Bartlett, Maidstone, watch and clock maker. Improvements in taps.

2792. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. An improved cowl or chimney pot. (A communication.)

2793. F. Castelnau, Villefranche, Haute Garonne, France. Improvements in the construction of two-wheeled vehicles or carriages.

2794. J. Mash, Bowden, Cheshire, engineer. Improvements applicable to safety valves and pressure or temperature gauges.

2795. S. Faulkner, Blackley, Lancashire, cotton spinner, J. Berry, Newton Heath, Lancashire, gentleman, and G. Harrison, Blackley, mechanic. Improvements in apparatus for grinding cards used in carding engines.

2796. S. Faulkner, Blackley, Lancashire, cotton spinner. Improvements in carding engines.

2797. J. Cutler, Gloucester-road, Upper Holloway. Improvements in the construction of ornamental fountains.

Dated November 11, 1863.

2801. T. M. Reade, Liverpool, architect, and J. Hewitt, Stanley, near Liverpool, plumber. Improvements in the apparatus for regulating and controlling the supply of water to water-closets and other purposes.

2802. J. Fottrell, Liverpool, merchant and warehouse owner. Improvements in deodorizing petroleum and other mineral oils.

2803. D. Dawson, Milnsbridge Chemical Works, Huddersfield. Improvements in the production of colours for dyeing.

2805. H. Melton, Regent-street, hatter to the Royal family. Improvements in shakos, military and other hats and caps.

2807. M. Stainton, South Shields, iron founder, and D. Lawson, South Shields, pattern-maker. Improvements in apparatus for steering ships and vessels.

2808. W. Clissold, Dudbridge Works, near Stroud, engineer. Improvements applicable to machinery for opening, cleaning, preparing, and carding wool and other fibrous substances.

2809. G. Haseltine, 12, Southampton-buildings, Chancery-lane, civil engineer. Improvements in endless chain horse powers. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated November 11, 1863.

2806. W. D. Richards, Boston, United States. Improvements in caloric or heated air engines. (A communication.)

Dated November 12, 1863.

2818. E. Rowland, Manchester, engineer. Certain improvements in apparatus for weighing solid bodies, and for measuring fluids, parts of which improvements are also applicable to the opening and closing of dampers.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, November 24, 1863.

1740. J. Mortimer. Dwelling-houses.
1745. J. Barton. Guard or fence.
1763. E. Sonstadt. Sodium.
1766. J. Slater. Bricks and tiles.
1767. E. Funnell. Self-acting signal.
1768. T. Wimpenny. Roving and spinning.
1770. W. T. Cheetham. Motive power.
1774. R. A. Brooman. Reducing charcoal to powder. (A communication.)
1775. R. A. Brooman. Telegraphing. (A communication.)
1777. D. Tamet. Breakwaters.
1781. J. N. Tayler and W. Austin. Ships.
1785. C. Stokes. Horse-collar.
1796. F. Lepoutre. Mechanical sector.
1797. T. Johnson. Washing and cleansing casks.
1801. R. Coenen. Winding, measuring, and sizing silk. (A communication.)
1803. A. Clark. Revolving shutters and blinds.
1806. G. Murdoch. Steam and vacuum gauges.
1809. F. A. Calvert. Opening, cleaning, and preparing fibrous substances.
1813. A. Smith. Dragging bristles.
1815. A. A. Pelaz. Printing stuffs.
1827. G. Haseltine. Harrowing. (A communication.)
1828. R. A. Brooman. Watches. (A communication.)
1831. W. E. Newton. Mats. (A communication.)
1842. L. L. J. Fillion. Extinguishing chimney fires and preventing explosions.
1863. F. and L. Ford. Imitation marbles.
1908. R. E. Bibby. Fire-proof cement.
1938. J. G. Pinède. Regulating speed of steam and hydraulic engines.
1939. W. P. Hodgson and J. V. Woodifield. Rivets.
1943. W. Clark. Taps. (A communication.)
2033. E. H. Bentall. Thrashing.
2051. J. Yates. Armour plates.
2062. J. B. C. Lange. Registering the distance travelled by vehicles.
2120. W. E. Newton. Breech-loading firearms. (A communication.)
2137. W. Whitworth and J. Wrigley. Furnaces.
2171. E. Alcan. Feeding wool into machines. (A communication.)
2372. A. Gleerup. Gas-burner. (A communication.)
2399. B. Brown. Sight-piece. (A communication.)
2648. J. Marshall. Expression of oil.
2650. J. C. Wilson. Mounting ordnance.
2663. W. E. Gedge. Permanent advertisement. (A communication.)
2678. J. Rawlings. Attaching cords to window sashes.
2695. J. Brigham and R. Bickerton. Reaping and mowing machines.
2771. L. Braham. Spectacles and hand-frames.
2816. E. Rowland. Weighing and measuring.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed November 18, 1863.

1240. E. Christmas.
1249. S. Rhodes.
1258. T. P. Salt.
1261. H. Wren and J. Hopkinson.
1268. J. Cassell.
1279. J. Fawcett.
1282. W. Snell.
1284. T. A. Blakeley.
1286. T. A. Blakeley.
1287. G. Stevens.
1290. J. Higgins and T. S. Whitworth.
1295. W. Cormack.
1297. J. S. Bickford and G. Smith.
1300. F. Potts and J. Key.
1312. G. Köttgen.
1313. H. B. Girard.
1315. J. Hilliar.
1330. A. Bastow.
1399. F. A. Calvert.
1403. T. Gray.
1405. W. Clark.
1413. W. C. Brocklehurst, J. Creighton, C. Makinson, and J. Creighton.
1422. R. C. Furley.
1448. M. Hatschek.
1539. J. Watts.
1692. G. Haseltine.
1762. W. Wood.
1998. C. C. Dennett.
2152. A. V. Newton.
2205. J. C. Lott.
2223. N. Thompson.
2314. I. de Angelis.

Sealed November 20, 1863.

1292. J. Sturgeon.
1301. R. A. Brooman.
1303. R. A. Brooman.
1304. F. Kingsbury.
1305. G. Smith.
1311. E. Hunt.
1322. J. Munro and R. Scott.
1365. W. Clark.
1880. H. A. Bonneville.

Sealed November 24, 1863.

1138. M. J. Roberts.
1321. A. Haley.
1331. H. C. Coulthard.
1333. C. Gammon.
1334. W. Palliser.
1340. H. Cartwright.
1342. T. Richardson.
1343. F. Osbourn.
1346. R. A. Brooman.
1349. A. Abadie.
1350. W. Loeder.
1351. J. J. Pôtel.
1352. G. H. Pierce.
1354. W. Green.
1364. J. Chalmers.
1387. G. Davies.
1429. B. Dobson and D. Greenhalgh.
1457. W. Walton.
1460. E. O. Hallett.
1476. G. Davidson.
2162. G. T. Bousfield.
2317. T. E. Vickers.
2356. J. Webster.
2397. E. W. Bullard.
2473. L. Lefebvre.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2837. O. Vandenburgh.
2845. A. V. Newton.
2857. C. Myring.
2861. W. H. Ralston.
2862. R. Jobson.
2865. D. Auld.
2867. G. E. Dering.
2874. B. Beniowski.
2885. S. Walker.
2886. J. H. Johnson.
2889. J. Fowler, R. Burton, and D. Greig.
2891. W. Leigh.
2895. G. F. Train.
2933. W. M. Storm.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2767. T. Roberts, J. Dale, and J. D. Pritchard.
2768. A. Clark.
2782. J. Broadley.
2840. G. Collier and J. W. Crossley.

LIST OF SPECIFICATIONS PUBLISHED.

For the Week ending November 21, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
326	0 10	717	0 4	728	0 4	740	0 10	746	0 8	752	0 4
692	0 10	718	0 4	732	1 6	743	0 4	747	0 4	753	0 4
709	0 10	722	0 4	734	0 8	744	0 4	748	0 4	755	0 4
713	0 10	726	0 4								

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p ct
IRON:—									
Welsh Bars, in London	per ton	7	10	0	to	0	0	0	
Nail Rods	do	8	0	0		8	10	0	
Hoops	do	10	10	0		0	0	0	
Sheets, single	do	11	10	0		0	0	0	
Staffordshire Bars	do	9	10	0		0	0	0	
Bars, in Wales	do	6	10	0		6	15	0	
Rails	do	7	0	0		0	0	0	
Foundry Pigs, at Glasg, No 1	do	3	0	0		3	6	0	
Swedish Bars	do	11	10	0		12	10	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		16	10	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	105	0	0		0	0	0	
Hammered Bottoms	do	115	0	0		0	0	0	
Flat Bottoms, not Hamrd.	do	110	0	0		0	0	0	
Tough Cake and Ingot	do	98	0	0		0	0	0	
Tile Copper	do	98	0	0		0	0	0	
Best Selected	do	101	0	0		0	0		
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	9	
Fine Foreign	per ton	100	0	0		102	0	0	
TIN:—									
English Block	per cwt.	5	15	0		0	0	0	2½
do Bar	do	5	16	0		0	0	0	
do Refined	do	6	0	0		0	0	0	
Banca	do	6	2	0		6	3	0	nett
Straits	do	5	17	0		0	0	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	9	0			10	0	
Second Quality	do	1	7	0			8	0	
Coke	do	1	3	6			5	0	
SPELTER:—									
On the spot	do	18	7	6			0	0	nett
ZINC:—									
English Sheet	do	24	0	0		0	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	38	0	0		0	0	0	2½

TIMBER, duty 1s. per load, drawback 1s.

Teak ... load	£12	0	£13	0
Quebec, red pine	3	10	4	10
„ yellow pine	3	10	4	10
St. John, N.B., yellow	0	0	0	0
Quebec oak, white	5	10	6	10
„ birch	3	10	4	10
„ elm	3	10	5	0
Dantzic oak	3	10	6	10
„ fir	2	10	3	10
Memel fir	3	5	3	10
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
„ yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
„ St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	18	10
St. John, white spruce	14	0	15	10
Yellow pine, per reduced C.				
Canada, 1st qual.	17	0	18	0
„ 2nd do.	11	0	12	0
Archangel, yellow	£13	0	13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
„ white	9	0	9	10
Gefle, yellow	10	10	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12ft. by 3 by 9 in.				
Christiania, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	2
PUMICE STONE per ton	5	10	9	0
OILS, &c.				
Seal, pale ... per tun	47	10	0	0
Sperm body	76	0	78	0
Cod	86	0	0	0
Whale, Sth Sea, pale	45	0	46	0
Olive, Gallipoli	58	10	59	0
Cocoanut, Cochin	47	10	0	0
Palm, fine	37	0	0	0
Linseed	39	0	0	0
Rapeseed, Eng. pale	41	10	42	0
Cottonseed	31	0	38	0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number:— Page

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 4, 1863.

BOILER INSPECTION.

It would prove anything but an uninteresting task to collect all that has been written on the subject of boiler explosions from Savary's time to the present. Such a compilation, especially if illustrated with drawings of all the mechanical arrangements proposed for their prevention, could not fail to prove attractive, perhaps useful. The work would be vast; yet this characteristic would but prove how ardently men have sought, by every conceivable adaptation of machinery, to prevent the recurrence of the frightful calamities which have invariably attended the employment of steam power. The want of an efficient safety apparatus has, indeed, been always the prominent idea in the minds of those who have turned their attention to the subject. Ingenious men, in every nation where steam power is employed, have still sought safety on the same general principles. It is apparently a matter of no moment, that these principles have been proved fallacious by the experience of a century. Precisely the same things are patented over and over again, pushed into notoriety, used largely, and praised for the time being; yet the journals of each day contain a record of catastrophes which such schemes, however ingenious, have proved utterly powerless to prevent. We do not suppose there is a boiler at work this week in the kingdom which is not provided with safety valves, lead plugs, floats, or possibly some other arrangements which ought to render an explosion impossible. Yet, before many days have lapsed, it is a matter of certainty that one or more of them will have exploded, carrying death and destruction into the centre of busy communities. This fact is so pregnant, so full of instruction, and so generally recognized as a proved thing, that it is remarkable in the extreme that all interested have not investigated the question in a more extended spirit. It seems strange that the sudden destruction of a steam generator should still be attributed either to something occult and mysterious, or to a cause which could not operate while the safety apparatus provided performs its assigned duty. It is patent to the most superficial, that the hosts of safety apppliances which have been fitted to boilers, for years back, have failed to reduce the number of explosions in any appreciable degree. Why this should be the case, we would have thought an interesting question; nevertheless it is generally passed over; and instruments which we have no doubt are capable of doing their duty in the most perfect manner, receive nothing but reproach and contumely should a steam generator to which they are fitted, unluckily chance to explode. If a jury try such a case, the gentlemen composing it usually consider the catastrophe as the result of an over—that is an exceptional—pressure of steam, or shortness of water. It is a matter of no consequence that witness after witness may prove that the gauges showed an abundance of water the minute before the event, and that the safety valve was in perfect order. Juries, in too many instances, refuse to believe the testimony afforded them by either gauges or witnesses, and come to the conclusion that the former must have been out of order and fallacious, or that the latter are interested, not very conscientious, and therefore not very trustworthy. Hence, in many instances, the accident is ascribed to causes which had nothing whatever to do with it, solely because the simple fact is overlooked, that no safety apparatus, of any kind, or however perfect, can do more than provide for certain exceptional contingencies, and that, until these contingencies do occur, they must remain utterly inoperative for good or for evil. When we reflect that all evidence goes to show in the most positive manner that explosions usually take place under the ordinary conditions of daily working, it is no longer difficult to understand how futile must be the attempt to check what has become a national evil by any improvements in mechanical appliances alone.

An explosion can only be the result of an over-pressure of steam, the weakness of the boiler plates, or of some mysterious phenomena for which we cannot account. We have not alluded to shortness of water as a cause, because that is already included under the head of want of strength in the generator; for almost the only way in which a red-hot plate can operate in causing, or rather permitting, an explosion, is by giving way. It is just possible, that in the case of some generators with a large heating surface and confined steam room, a red-hot plate might produce steam enough, on the influx of water, to overcome the resistance of the plates, nevertheless, this is very unlikely. In 1832-3, the members of the Franklin Institute made a series of elaborate experiments on steam, in the States. Among others, they heated a small boiler red-hot and pumped cold water into it, the result was not an explosion; the boiler leaked at all the seams, in consequence of the contraction of the plates; and it was found impossible to raise more than a few pounds of pressure in this way. This is pretty conclusive evidence against the red-hot-plate theory. As to the mystical one, we cannot help regarding it as an absurdity, unworthy of being entertained by any one pretending to scientific acquirements. As it is, it can only be applicable to the *violence* of an explosion, a subject which we have treated of at length from time to time. Just now, we do not wish to deal with the so-called mysterious, but with the evident; and, in pursuit of this intention, we assert that the great-bulk of evidence goes to show that immeasurably the larger proportion of the vast number of explosions, which spread misery through our mining and manufacturing districts, are the result of negligence and (shall we add?) parsimony. We admit that, in a very few exceptional cases, explosions do occur from causes which are unknown, or at least, not readily discoverable; but such instances are so rare, that they may be regarded as little more than phenomena—interesting, it is true, to the scientific man as problems in natural philosophy, but from their great rarity influencing the question in a social point of view, very little, if at all. It is to be regretted, that from the interest these have excited, attention has been, to a great degree, called away from the consideration of cases where the causes have been patent—cases which appear to increase rather than diminish in the frequency of their recurrence. Were it possible for us to become acquainted with the actual events in the history of the thousands of steam boilers in daily use, we believe that all amazement at an explosion, and speculation as to its cause, would be exchanged for a feeling of surprise that these catastrophes do not take place more frequently. We have attributed explosions to parsimony and negligence; we may be accused of writing harshly; we care not, so long as we write truly. These events bear the same relation to the faculty of engineers, that cholera and consumption do to the faculty of medicine. Their constant recurrence, is either a disgrace to the science of the age, or else, as is really the case, it shows that the evil is one which science alone is powerless to redress. If remediable, as we believe it to be, it certainly is not so by mere scientific discussion. It has become a social evil—an evil deeply concerning the many; and it is to the consideration of the question in this light, that we would urge, not only the engineer, but the public at large.

Were there no such thing as corrosion, boilers would probably last almost indefinitely, and explosions would be few and far between. As it is, their duration depends on many circumstances, scarcely so well understood as they should be. Destructive influences often operate with extreme and unaccountable rapidity. Plates perfectly sound to-day may be almost eaten through in the course of a very few months; and there is no means whatever of ascertaining the true state of affairs, save by frequently repeated, and careful inspection. In this system lies the true source of safety. It alone defines the true source of danger, and dictates the proper preventive measures which are required to avoid a catastrophe. No mechanism, however ingenious, can afford daily information of the exact state of the plates which form a boiler; and mechanical expedients cannot, by possibility, provide for the consequences of that deterioration to which they are exposed from the first moment a boiler is set to work. Because an iron tube, exposed to an intense heat, will bear a certain pressure when new, or even when much worn, that is no reason that it should always do so.

Our pages contain the monthly reports of the Manchester Boiler Association—they are fearfully suggestive. That for the recent month, contains a record of no fewer than 106 defective boilers, out of 381 examined; 14 of the defects being of the gravest character, and likely to lead to the most disastrous results. "An illustration," says Mr. Fletcher, "has lately been met with, of the importance of removing portions of mid-feather walls, in order to give an opportunity of examining the plates. On this being done, at the instance of the Association, in the case of a boiler lately put under its care, the bottom, although *presumed by its owner and engineer to be perfectly sound, was found to be nearly eaten through by corrosion, and on the very point of explosion.*" Such a fact as this is not a mere isolated example of what may take place. It is an illustration of what is daily going on; and it points out, in the most powerful light, the absolute necessity for a united organization all over the kingdom, to carry out, in the most perfect manner, those principles of inspection inaugurated by the Manchester men. "Six explosions," writes Mr. Fletcher, "have occurred during the last month, resulting in the death of eleven persons and the injury of eighteen others—*not one of the boilers in question was under the inspection of the Association.*" Nearly every report contains the same announcement of an almost perfect immunity from danger, following on the labours of the Committee of Inspection. It becomes criminal any longer to shut our eyes to such facts, and refuse to accept the means of safety placed at our disposal.

No one who has not resided for a lengthened period in our mining and manufacturing districts, can conceive of the reckless disregard of human life displayed in the employment of steam power. Boilers are patched in the rudest manner while they will hold together. We have seen a plain cylindrical boiler of 4 ft. in diameter and some 30 ft. long, carrying 60 lbs. steam, with three patches over the fur-

nace side walls, each consisting of a plate more than a square foot in area, covering a rent, the result of corrosion. These patches were not rivetted on. Each was fixed in its place by a single ¾ in. bolt, tapped into a flat bar 2½ in. by ½ in. and a couple of feet long, placed outside the shell, the plate being placed inside and held up to its place by the pressure of the steam, the joint being made tight (?) by red-lead and a bit of canvas. This kind of patch is common all through Staffordshire, and is used because the plates will not bear rivetting from wear. We have seen the boiler-maker, ere now, send his hammer through the so-called sound plate, by accidentally striking it, instead of the rivet, which he wished to close. We might accumulate a volume of such instances were it necessary.

Those who employ steam power should recollect that the duration of a boiler is far from being a mere question of time. It depends on so many circumstances that it is impossible to say what may be its condition without frequent and careful inspection by those who can form a proper opinion; and we may conclude this article by pointing out that every man who makes use of steam power, is guilty of criminal negligence if he disregards the means of safety which inspection alone can place ready to his hand.

THE ORDNANCE REPORT, 1863, CONDENSED; AND CONCLUSIONS FROM IT.

No. IV.

THE MERSEY STEEL AND IRON COMPANY.

SUPPLEMENTARY to part No. III., which incontestably proves the discouragement every competitor of the Elswick Company has encountered at the War-office, the case of the Mersey Steel and Iron Company stands conspicuous and deserves especial notice.

The celebrated Horsfall gun was manufactured by the last-named company in 1854. It was first tried on the sands near Liverpool. The result was so remarkable, proving the great range and power of the gun, that the manufacturers, in a truly patriotic spirit, presented the piece, which had cost many thousand pounds, to the British Government. It was shipped in the Mersey and delivered to the Ordnance Department. Some time afterwards it was fired on the beach near Portsmouth, with results which again proved its immense range and ought to have fixed the attention of the War-office on its capabilities. But no notice was taken of these experiments for some time after, until, in 1862, in consequence of the subject being mentioned in the House of Commons, and on the complaint of the constructors, that their gun had not been submitted to fair a trial in competition with the Armstrong gun, it was transported to Shoeburyness, where it was fired with extraordinary success, sending its missile through and through the "Warrior" target, as if the structure had been a bandbox. It caused apalling destruction to the armour and frame of the ship, making a ragged aperture 2 ft. to 3 ft. square. Two or three such smashing shots below the water-line would have sunk the "Warrior." The event created a sensation at the time; and it was thought the natural result would be an order, from the War Department to the Mersey Company, for the construction of another gun of the same calibre, with improvements, which the company was prepared to introduce, with a diminution in the weight. But no encouragement was held out to them. The opportunity, which has always been afforded to Sir W. Armstrong and his company, to make new trials and remedy defects revealed by experiments, at the Governmens expense, was withheld from the liberal constructors of the Horsfall gun. Their legitimate expectations were disappointed.

The occasion, however, was not lost to the Elswick Company, which was supported as usual by the War Department. If the Mersey could produce a 13-in. wrought-iron gun, why should not Elswick equal or surpass it? With the Government sanction, whilst the former company received the cold shoulder, the latter proceeded to make the so-called 600-pounder, which was tried at Shoeburyness, the 19th November last. This gun had a fair trial, which is more than can be said of the Mersey gun. The latter was fired four or five times, as if reluctantly, and the results were reported in the *Times* in a disparaging tone. With the Armstrong great gun, sixteen rounds were fired at different elevations; a whole day was devoted to the experiments, which the *Times* reporter, inspired no doubt by the War-office, recorded with great precision and in exaggerated terms of panegyric.

The Mersey monster, however, was substantially as great a success as the Armstrong monster, which, although called a 600-pounder, is really only a 300-pounder, being within the fraction of an inch, of the same calibre as the former, so that both guns are of the same power and calculated to fire solid round shot, or elongated projectiles, of the same weight with the same charges.

This is another instance of flagrant injustice to a competitor of the Elswick Company. If that eminent and enterprising firm, the Mersey Company, had had the same favour as the Elswick Company, profiting by experience, they would doubtless have produced a gun reduced in weight, and far superior to their first essay, which might have successfully rivalled the great Armstrong shunt. At all events justice has not been done to them.

In the Appendix to the Ordnance Report, pp. 368—370, we find War-office reports which place the conduct of that Department to the Mersey Company in a very doubtful light. In December, 1860, the Company delivered to the War-office two blocks of their solid forged metal, for the purpose of being tested in comparison with Armstrong coils. "The two blocks were manufactured, at the Royal Gun Factory, into a 12-pounder and a 40-pounder gun, bored, turned, and fitted exactly in accordance with those two classes of Armstrong guns." These Mersey guns were subjected to the severest endurance, proofs similar to those by which the Armstrong guns are tested. The Ordnance Select Committee, in September, 1862, at the conclusion of the experiments, reported to the Secretary of State, "that they consider that both these guns have shown an endurance, if not fully equal to that of guns made on the coil system, yet at least ample for the requirements of the service;" and "the Committee request to be furnished with particulars of cost, that they may be in a position to form an opinion whether it is worth while, with a view to ultimate economy of manufacture, to test more Mersey Company's guns."

The required information having been furnished, shows "that the cost of the Mersey steel guns is £185 for the 40-pounder, and £75 for the 12-pounder, against £249 and £90 respectively for the Armstrong coil-guns, being a saving of £64 on the 40-pounder, and £15 on the 12-pounder gun." These differences are equal to a reduction of 25 and 16 per cent. on the pieces—an enormous reduction when reckoned upon the millions expended on Armstrong ordnance.

The Report of the Ordnance Select Committee concludes by "recommending the War-office to call upon the Mersey Company to supply three 40-pounder blocks and three 12-pounder blocks, similar to those previously furnished, in order that they may be bored, rifled, and finished in the Royal Gun Factory for further experiments."

It appears that the heads of the War Department gave no effect to this honest and economical recommendation. The Mersey Company were left in ignorance of the success which had attended the first trial by the Government of their metal in solid forgings, until the Report we are reviewing was printed by order of the House of Commons. No wonder that the gentlemen, who compose the Mersey firm, like so many others, who imagined they could obtain a fair trial from the War-office, withdrew from competition in perfect disgust, when they found it useless to contend against Armstrong influence in high quarters.

THE ARMSTRONG SYSTEM.

The country has paid nearly three millions sterling for the reconstruction of its artillery; three million is a large sum, and the country has a right to know what it has got for its money. We would gladly lend our aid to afford that valuable information, but we cannot. In vain have we searched through the seven hundred folio pages of the Report; we can nowhere discover value received for the sum expended, beyond the guns and projectiles delivered into the national arsenals. If these munitions of war should prove to be worthless, there will be nothing to represent the money spent. We do not affirm that that will prove to be the case; the Report shows that opinions are divided on the subject; and with some share of fairness, it may be said, that the value of the Armstrong ordnance yet remains to be proved, by the test of actual warfare. So far as we at present know anything positive from that, the only reliable field of experience, the evidence is inconclusive. The reports on the practice with the field batteries in China are conflicting. On one occasion, in the attempt to breach the Taku Forts, smooth-bore guns were brought up to do the work which the rifled Armstrongs failed to accomplish. Naval officers are nearly unanimous in condemning the heavy Armstrongs as broadside guns. The experiments against armour plates have proved that, for penetration, the 100-pounder Armstrong is inferior to the cast-iron 68-pounder; the First Lord of the Admiralty has given evidence to that effect in the following words:—"For naval purposes, at 200 yards, our old 68-pounder is a more powerful gun than the 100-pounder Armstrong gun."

Bnt still we are assnred by the Armstrong party, of which the *Times* is the exponent, that the country is in possession of an equivalent for its large expenditure, in the valuable acquisition of the "Armstrong system."

We have diligently sought by the light of the compendious evidence in the Report we are analyzing, to ascertain what that "system" is: but we have been baffled; and our only consolation is, that the Select Committee on Ordnace, at the conclusion of their arduous labours, found themselves in the same predicament. They do not venture to affirm what the system is; but summing up the pregnant question, they introduce the following paragraph in their Report:—"The combination of construction (coils of iron welded together, formed into hoops shrunk one over another), breech-loading, rifling, and coating the projectiles with soft metal, *came to be viewed* as the Armstrong system." In the proceedings of the Committee, it is reported, that the question "that those words be inserted," being

put, the resolution was unanimously agreed to. This proves that the most strenuous supporters of Sir William Armstrong amongst the members of the Committee, and they were not few in number, were unable to give a more definite expression to their conception of his "system."

So numerous are the facts, so contradictory are the opinions and authorities on both sides, that it is no wonder the Committee declined pledging themselves to any decisive definition of the Armstrong system. Even Colonel St. George and Captain Jarvis, and other War-office officials, including General Peel himself, would not venture to decide the question.

There was one way of setting it at rest, the production of the specifications of the Armstrong patents; but fruitless were the endeavours of the independent members of the Committee to obtain an inspection of those documents. The earnest attempts of some of them to get at the real nature of the "system" from the descriptions in the specifications, which would have settled the point, were defeated by a peremptory refusal on the part of the Government to produce them.

The question of the Armstrong system is in so vague and unsatisfactory a condition, it is difficult to deal with it summarily. In our next number we propose to show that, in the general description of the so-called system, and in its details, as explained by the evidence, there is no novelty of idea, no invention of Sir W. Armstrong, and no method of construction, or process of manufacture, which was not previously practised or known to other ordnance engineers, and which could not have been carried into execution more effectively, more promptly, and more economically by many other manufacturers, if the Government had afforded them the opportunity of competing on equal terms with the Elswick Company.

(To be continued.)

INDUSTRIAL BIOGRAPHY.*

Who has not read Mr. Smiles' "Lives of the Engineers"? Pleasant volumes, abounding in quaint strange stories of life struggles, of battles fought and won by mind over stern matter, aye, and more difficult task, over the opposing intellects of men, often envious, and always sceptical. Mr. Smiles has established a world-wide reputation as the champion of the engineer and the inventor. What matter, that he sometimes acts the part of knight-errant, and couches his lance in defence of those who have no claim on his services, simply because they appear to enjoy scant justice at the hands of others? His books are none the less readable, that he throws the halo of a fine imagination around the acts of his heroes, investing them with a simplicity of purpose, a nobleness of heart, which is all too rare in the world. With the memory of his last book before us, need we say that we welcome yet another wrought by the same brain. "Industrial Biography" is a happy title; and Mr. Smiles tells us, in a few phrases, how it is that he came to give the volume to the world. While preparing the "Lives of the Engineers," the industrious searcher through the records of the past, frequently came across the tracks of celebrated inventors, mechanics, and iron-workers—the founders in a great measure of the modern industry of Britain, whose labours seemed to him well worthy of being traced out and put on record, and the more so, that their lives presented many points of curious and original interest. Our author hardly does himself justice in stating that his principal task has lain in selecting and arranging the materials placed at his disposal, supplied, for the most part, by the descendants or surviving contemporaries of the men whose leading characteristics he records. The volume before us bears little evidence of the heterogeneous mass of papers from which it has been built up with a prudent and skilful hand. Traces of the original material, it is true, start out here and there in bold relief, through its pages; but they only serve to impart a quaint tone of truthful simplicity to the whole, which is very pleasing. Thus, in the first chapter, which treats of "Iron and Civilization," in alluding to the scarcity of iron, he writes:—

To supply themselves with swords and spear-heads, they (the Scots under Wallace) imported steel from Flanders, and the rest they obtained by marauding incursions into England. The district of Furness, in Lancashire—then, as now, an iron producing district—was frequently ravaged with that object, and, on such occasions, the Scots seized and carried off all the manufactured iron they could find, preferring it, though so heavy, to every other kind of plunder. About the same period, however, iron must have been regarded as almost a precious metal in England itself; for we find that in Edward III.'s reign, the pots, spits, and frying-pans of the Royal kitchen were classed among his Majesty's jewels.

The same famine of iron prevailed to a still greater extent in the Highlands, where it was even more valued, as the clans lived chiefly by hunting, and were in an almost constant state of feud; hence, the smith was a man of almost indispensable importance among the Highlanders; and the possession of a skilful armourer was greatly valued by the chiefs. The story is told of some delinquency having been committed by a Highland smith, on whom justice must be done; but, as the chief could not dispense with his smith, he generously offered to hang two weavers in his stead!

We may point out the chapter on Andrew Yarranton as affording a peculiar example of this style.

It is to be wished that Mr. Smiles had possessed a more thorough knowledge of engineering than he does. In the biography of men he is at home, successful, and as a consequence, charming, but in the biography of a machine or a tool, he is usually inaccurate, loose in his style, and scarcely perspicuous. We cannot have everything, however, and are well enough content with the food for thought which Mr. Smiles supplies. In some of his sketches of character, he is peculiarly happy: witness the following of the late Henry Maudslay:—

Like every good workman who takes pride in his craft, he kept his tools in first-rate order, clean and tidily arranged, so that he could lay his hand upon the thing he wanted at once, without loss of time. They are still preserved in the state in which he left them, and strikingly illustrates his love of order, "nattiness," and dexterity. Mr. Nasmyth says of him, that you could see the man's character in whatever work he turned out, and as the connoisseur in art will exclaim at sight of a pictnre, "That is Turner," or that is "Stansfield," detecting the hand of the master in it, so the experienced mechanician, at sight of one of his machines or engines, will be equally ready to exclaim, "That is Maudslay;" for the characteristic style of the master mind is as clear to the experienced eye in the finished machine as the touches of the artist's pencil are in the case of the finished picture. Every mechanical contrivance that became the subject of his study, came forth from his hand and mind rearranged, simplified, and made new, with the impress of his individuality stamped upon it. He at once stripped the subject of all unnecessary complications, for he professed a wonderful facility of *knowing what to do without*—the result of his clearness of insight into mechanical adaptations, and the accurate and well defined notions he had formed of the precise object to be accomplished. "**Every member or separate machine in the system of block machinery,**" says Mr. Nasmyth, "**is full of Maudslay's presence. And in that machinery, a constructed by him, is to be found the parent of every engineering tool, by the aid of which we are now achieving such great things in mechanical construction. To the tools, of which Maudslay furnished the prototypes, are we mainly indebted for the perfection of our textile machinery, our locomotives, our marine engines, and the various implements of art, of agriculture, and of war. If any one who can enter into the details of this subject will be at the pains to analyze, if I may so term it, the machinery of our modern engineering workshops, he will find in all of them the strongly marked feature of Maudslay's parent machine, the slide rest and slide system—whether it be a planing machine, a slotting machine, a slide lathe, or any other of the wonderful tools which are now enabling us to accomplish so much in mechanism.**"

The same tone pervades the whole book. Mr. Smiles treats of men who have risen to fame by a life-long struggle, indomitable energy, and a thorough reliance on their own powers. To write the biography of men like Dud Dudley, Andrew Yarranton, Henry Cort, or Joseph Clement, must constitute a pleasure in itself; while to read it, as Mr. Smiles has put it before us, conveys a feeling of something more than pleasure. To do full justice to the book in a short article, is beyond our power; the public must read and enjoy for themselves. We append one quotation more, the utmost that our limits will allow, and we must add a word of praise for the cheap and unpretending form in which such a charming book is laid before the public:—

The excellence of Mr. Clement's tools, and his well-known skill in designing and executing work requiring unusual accuracy and finish, led to his being employed by Mr. Babbage to make his celebrated Calculating or Difference Engine. The contrivance of a machine that should work out complicated sums in arithmetic with perfect precision, was, as may readily be imagined, one of the most difficult feats of the mechanical intellect. To do this was in an especial sense to stamp matter with the impress of mind, and render it subservient to the highest thinking faculty. Attempts had been made at an early period to perform arithmetical calculations by mechanical aids more rapidly and precisely than it was possible to do by the operations of the individual mind. The preparation of arithmetical tables of high numbers involved a vast deal of labour, and even with the greatest care errors were unavoidable and numerous. Thus in a multiplication-table prepared by a man so eminent as Dr. Hutton for the Board of Longitude, no fewer than forty errors were discovered in a single page taken at random. In the tables of the "Nautical Almanac," where the greatest possible precision was desirable and necessary, more than five hundred errors were detected by one person; and the Tables of the Board of Longitude were found equally incorrect. But such errors were impossible to be avoided so long as the ordinary modes of calculating, transcribing, and printing continued in use.

The earliest and simplest form of calculating apparatus was that employed by the schoolboys of ancient Greece, called the Abacus; consisting of a smooth board with a narrow rim, on which they were taught to compute by means of progressive rows of pebbles, bits of bone or ivory, or pieces of silver coin, used as counters. The same board, strewn over with sand, was used for teaching the rudiments of writing and the principles of geometry. The Romans subsequently adopted the Abacus, dividing it by means of perpendicular lines or bars, and from the designation of calculus which they gave to each pebble or counter employed on the board, we have derived our English word to *calculate*. The same instrument continued to be employed during the Middle Ages, and the table used by the English Court of Exchequer was but a modified form of the Greek Abacus, the chequered lines across it giving the designation to the Court, which still survives. Tallies, from the French word *tailler*, to cut, were another of the mechanical methods employed to record computations, though in a very rude way. Step by step improvements were made; the most important being that invented by Napier of Merchiston, the inventor of logarithms, commonly called *Napier's bones*, consisting of a number of rods divided into ten equal squares and numbered, so that the whole when placed

* "Industrial Biography: Iron-workers and Tool-makers." By Samuel Smiles. London: John Murray, 1863.

together formed the common multiplication table. By these means various operations in multiplication and division were performed. Sir Samuel Morland, Gunter, and Lamb introduced other contrivances, applicable to trigonometry; Gunter's scale being still in common use. The calculating machines of Gersten and Pascal were of a different kind, working out arithmetical calculations by means of trains of wheels and other arrangements; and that contrived by Lord Stanhope for the purpose of verifying his calculations with respect to the National Debt was of like character. But none of these will bear for a moment to be compared with the machine designed by Mr. Babbage for performing arithmetical calculations and mathematical analyses, as well as for recording the calculations when made, thereby getting rid entirely of individual error in the operations of calculation, transcription, and printing.

The French Government, in their desire to promote the extension of the decimal system, had ordered the construction of logarithmical tables of vast extent; but the great labour and expense involved in the undertaking prevented the design from being carried out. It was reserved for Mr. Babbage to develop the idea by means of a machine which he called the Difference Engine. This machine is of so complicated a character that it would be impossible for us to give any intelligible description of it in words. Although Dr. Lardner was unrivalled in the art of describing mechanism, he occupied 25 pages of the *Edinburgh Review* (vol. 59) in endeavouring to describe its action, and there were several features in it which he gave up as hopeless. Some parts of the apparatus and modes of action are indeed extraordinary—and perhaps none more so than that for ensuring accuracy in the calculated results—the machine actually correcting itself, and rubbing itself back into accuracy, when the disposition to err occurs, by the friction of the adjacent machinery! When an error is made, the wheels become locked and refuse to proceed; thus the machine must go rightly or not at all—an arrangement as nearly resembling volition as anything that brass and steel are likely to accomplish.

This intricate subject was taken up by Mr. Babbage in 1821, when he undertook to superintend for the British Government the construction of a machine for calculating and printing mathematical and astronomical tables. The model first constructed to illustrate the nature of his invention produced figures at the rate of 44 a minute. In 1823 the Royal Society was requested to report upon the invention, and after full inquiry the committee recommended it as one highly deserving of public encouragement. A sum of £1,500 was then placed at Mr. Babbage's disposal by the Lords of the Treasury for the purpose of enabling him to perfect his invention. It was at this time that he engaged Mr. Clement as draughtsman and mechanic to embody his ideas in a working machine. Numerous tools were expressly contrived by the latter for executing the several parts, and workmen were specially educated for the purpose of using them. Some idea of the elaborate character of the drawings may be formed from the fact that those required for the calculating machinery alone—not to mention the printing machinery, which was almost equally elaborate—covered not less than four hundred square feet of surface! The cost of executing the calculating machine was of course very great, and the progress of the work was necessarily slow. The consequence was that the Government first became impatient, and then began to grumble at the expense. At the end of seven years the engineer's bills alone were found to amount to nearly £7,200, and Mr. Babbage's costs out of pocket to £7,000 more. In order to make more satisfactory progress, it was determined to remove the works to the neighbourhood of Mr. Babbage's own residence; but as Clement's claims for conducting the operations in the new premises were thought exorbitant, and as he himself considered that the work did not yield him the average profit of ordinary employment in his own trade, he eventually withdrew from the enterprise, taking with him the tools which he had constructed for executing the machine. The Government also shortly after withdrew from it, and from that time the scheme was suspended, the Calculating Engine remaining a beautiful but unfinished fragment of a great work. Though originally intended to go as far as twenty figures, it was only completed to the extent of being capable of calculating to the depth of five figures, and two orders of differences; and only a small part of the proposed printing machinery was ever made. The engine was placed in the museum of King's College in 1843, enclosed in a glass case, until the year 1862, when it was removed for a time to the Great Exhibition, where it formed perhaps the most remarkable and beautifully executed piece of mechanism—the combined result of intellectual and mechanical contrivance—in the entire collection.

Clement was on various other occasions invited to undertake work requiring extra skill, which other mechanics were unwilling or unable to execute. He was thus always full of employment, never being under the necessity of canvassing for customers. He was almost constantly in his workshop, in which he took great pride. His dwelling was over the office in the yard, and it was with difficulty he could be induced to leave the premises. On one occasion Mr. Brunel, of the Great Western Railway, called upon him to ask if he could supply him with a superior steam-whistle for his locomotives, the whistles which they were using giving forth very little sound. Clement examined the specimen brought by Brunel, and pronounced it to be "mere tallow-chandler's work." He undertook to supply a proper article, and after his usual fashion he proceeded to contrive a machine or tool for the express purpose of making steam-whistles. They were made and supplied, and when mounted on the locomotive the effect was indeed "screaming." They were heard miles off, and Brunel, delighted, ordered a hundred. But when the bill came in, it was found that the charge made for them was very high—as much as £40 the set. The company demurred at the price—Brunel declaring it to be six times more than the price they had before been paying. "That may be," rejoined Clement, but mine are more than six times better. You ordered a first-rate article, and you must be content to pay for it." The matter was referred to an arbitrator, who awarded the full sum claimed. Mr. Weld mentions a similar case of an order which Clement received from America to make a large screw of given dimensions "in the best possible manner," and he accordingly proceeded to make one with the greatest mathematical accuracy. But his bill amounted to some hundreds of pounds, which completely staggered the American, who did not calculate on having to pay more than £20 at the utmost for the screw. The matter was, however, referred to arbitrators, who gave their decision, as in the former case, in favour of the mechanic.

One of the last works which Clement executed as a matter of pleasure, was the building of an organ for his own use. It will be remembered that when working as a slater at Great Ashby, he had made flutes and clarionets, and now in his old age he determined to try his skill at making an organ—in his opinion the king of musical instruments. The building of it became his hobby, and his greatest delight was in superintending its progress. It cost him about two thousand pounds in labour alone, but he lived to finish it, and we have been informed that it was pronounced a very excellent instrument.

Clement was a heavy-browed man, without any polish of manner or speech; for to the last he continued to use his strong Westmoreland dialect. He was not educated in a literary sense; for he read but little, and could write with difficulty. He was eminently a mechanic, and had achieved his exquisite skill by observation, experience, and reflection. His head was a complete repertory of inventions, on which he was constantly drawing for the improvement of mechanical practice. Though he had never more than thirty workmen in his factory, they were all of the first class; and the example which Clement set before them of extreme carefulness and accuracy in execution rendered his shop one of the best schools of its time for the training of thoroughly accomplished mechanics. Mr. Clement died in 1844, in his sixty-fifth year; after which his works were carried on by Mr. Wilkinson, one of his nephews; and his planing machine still continues in useful work.

LIGHTING ENGINE-ROOMS.

We have recently had occasion to allude in our pages to the use of Trachsell's ozone gas as a means of lighting the engine-room of the "Warrior." This gas is about 28 times heavier than the atmosphere, and it therefore becomes necessary to carry it to the burner by means of a current of air. This is obtained by a double india-rubber bellows or blower, worked by a weight and geared wheels, which carries a current equal to 12·33 cubic feet per hour, or 148 cubic feet in twelve hours, absorbing 307·469 cubic inches of ozone—equal to 1·102 gallons for fifteen lights for twelve hours—each light being equal to that of three composite candles, at eight to the pound. The cost of lighting the engine-room and screw alley with fifteen of the ozone lights for twelve hours is 4s. 5d., against 17s. 4d. for 33 oil and candle lamps, the ozone gas giving 11 per cent. more light.

M. l'Abbé Moigno transferred the paragraph which we have already inserted, to the pages of his able journal, *Le Monde*, appending the following remarks:—"Our readers will recognise in this apparatus, the gas lamp of M. Mille, with an exception altogether in favour of our clever friend. M. Mille uses neither an air-pump nor falling weight, nor any machinery whose motion is necessary to the maintenance of light. He has, in fact, brought his invention to a remarkable degree of perfection, combining simplicity with perfect efficiency. We shall shortly place before our readers details of a simple tin apparatus, installed within our library, which at the expense of 1½ kilogramme of paraffine, supplies us for twenty hours with a light far more intense than that afforded by a very large moderator lamp, usually consuming 50 grammes of oil per hour. Atmospheric air, simply by its natural tendency to diffusion, freely enters the apparatus and takes up, at all temperatures, those constituents which are necessary to convert it into a gas of far better quality than that ordinarily employed for the purposes of illumination; the light possessing a a red rather than a blue tinge. The simplicity of the arrangements has led to general admiration; and it seems certain that, ere long, this system of illumination will be universally adopted. It is eminently economical. The heaviest class of petroleum oils will not rise freely in the wick, and, being consequently burned with difficulty, are comparatively worthless: on M. Mille's system, however, they can be converted into illuminating gas at any temperature, without the use of retorts, tubing, gasometers, &c."

All this appears very interesting. *Le Monde* is an authority on such subjects; and we shall take care to place a description of M. Mille's lamp before our readers at the earliest possible moment.

TRACTION ENGINES AT WOOLWICH.

The following is an Admiralty return recently transmitted from Woolwich in reference to the traction-engine:—"The engine has been at work in Woolwich dockyard during the past twelvemonth, having been working continuously all the time, sometimes night as well as day. The machine is now in as good repair as when it was delivered. The cost of working, including maintenance and repairs, is under 20s. per day, while the work done is equal to one team of horses and twenty-five labourers. Since the engine has been employed in the yard two teams of horses have been disposed of with a view to economy." We trust that the day is not distant when the locomotive will take a prominent place in the highway and byeway traffic of the nation. It is most desirable that such facts as the above should be placed before the public in an accurate form, by those who employ this class of machinery or feel interested in its success.

NEW PUMPING MACHINERY.

We hope soon to be enabled to place before our readers a detailed description of a remarkable system of pumping recently invented by a French engineer, M. Beaumont, and spoken of in high terms by the Continental scientific press; the gentlemen connected with which inform us, in very plain terms, that the new machine will inaugurate an era in the practice of raising water in large quantities, and that it is like nothing which has gone before either in its general arrangements or its powers. All this must be received with a proper amount of caution. We know little or nothing about the machine at present, except that it consists of a series of horizontal superimposed revolving cylinders, provided with a peculiar arrangement of cells, near or at their circumference, and so arranged that the water raised by the lower cylinder is poured into that next above it; the process being repeated until it arrives at the reservoir to be filled.

An experimental apparatus has been constructed and set to work both at Strasbourg and Mulhouse, in the presence of nearly all the resident members of the Société Industriel. The official report has not yet reached us in a complete form; but the results obtained are stated as being extremely satisfactory; about 2,000 gallons per minute having been raised to a height of some 9 ft. by a steam engine indicating between 4 and 5-horse power.

TRIAL OF SHAND AND MASON'S STEAM FIRE-ENGINE.

Messrs. Shand and Mason have recently completed a steam fire-engine (the twenty-fifth turned out by the firm within the last few years), for the Watling-street Station of the London Fire Brigade. The principal novelties embraced in the construction of this machine are its small size and weight, 27 cwt., and an important improvement by which access can be got in a moment, to not only the foot valves of the pump, but to the bucket-plunger as well. In other respects, the engine resembles that which took the first prize in the small class at the Crystal Palace last summer.

An experimental trial took place on Saturday at Addington-square, Camberwell, on the banks of the Grand Surrey Canal. Steam was raised to 60 lbs. pressure in twelve minutes with ordinary firing. Unfortunately, there was no known standard at the spot by which either height or distance could be accurately measured. A fair estimate, may, however, be made of the power of the machine, from the pressure maintained in the air-vessel. The first jet used was one of ⅞ of an inch diameter, the pressure in air-vessel being 90 lbs. to 100 lbs. on the square inch, equivalent to at least 150 ft. of jet in vertical height; with a 1 in. jet the pressure was 80 lbs.; with 1⅛ in., 60 lbs. Steam was maintained at 100 lbs. without difficulty. The engine was, however, exposed to a more severe practical test on Monday night, when it did good service at a fire in Lamb's-passage, Chiswell-street, adjoining Whitbread's brewery, on which occasion it was at work without intermission for two hours, propelling water through nine 40 ft. lengths of hose, and a 1 in. jet, with a pressure of 60 lbs. in the air-vessel. We understand that Messrs. Shand and Mason are doing a considerable foreign trade in steam fire-engines just now.

TRIAL TRIP OF THE "ARETHUSA."

The "Arethusa," 35, screw frigate, was taken on Wednesday week from her moorings in Sheerness harbour to the measured mile off Maplin Sands, for the final trial of her machinery, previous to her being placed on commission, Captain W. K. Hall, commanding the Steam Reserve at Sheerness, having command of the vessel. Mr. John Dinnen, Inspector of Machinery from the Admiralty, was in attendance on the part of the Government; and Messrs. Matthews and Holliday were also present from the firm of Messrs. John Penn and Sons, constructors of the engines. The "Arethusa" was built as a sailing vessel at Pembroke 18 years ago, from designs by Sir W. Symonds, the then Surveyor of the Navy, but she has since been lengthened 41 ft. amidships, and converted into a screw frigate at Chatham dockyard. Her dimensions now are:—Extreme length between perpendiculars, 252 ft.; length of keel for tonnage, 217 ft.; extreme breadth, 52 ft. 8 in.; breadth for tonnage, 52 ft. 5 in.; depth of hold, 17 ft. 1 in.; and total amount of burden, 3,142 tons. The "Arethusa," together with the "Octavia" and the "Constance," vessels of a similar class, have each been fitted with machinery constructed with a view to obtain a greater amount of power at a less working cost than any yet introduced into the Navy. The "Arethusa" is fitted with a pair of expansive trunk engines with two cylinders 86½ in. in diameter, the trunk being 33 in. in diameter, and the length of stroke 42 in., with surface condensers, containing nearly 6 miles of 1-inch tubing. The boilers, four in number, with four furnaces to each, are fitted with superheating apparatus. The propeller is Griffith's patent, pitch 20 ft. to 26 ft., present pitch 23 ft. During the trial six runs were made at full boiler power. The results were an average speed of 11·043 knots an hour; the revolutions of engines 65 per minute; pressure of steam 23 lbs.; vacuum 27¼ lbs. At half boiler power only two runs were made. The results were an average speed of 8·780 knots, 52 revolutions, pressure of steam 16 lbs., vacuum 26 lbs. The circle was made at full boiler power, helm port 23½ degrees in 7 minutes 1 second, the diameter of the circle being 501 yards; with half the boiler power, helm starboard 28 deg., in 7 minutes 47 seconds, the diameter being 399 yards. The draught of water during the trial was 20 ft. 3 in. forward and 22 ft. 7 in. aft., the vessel being fully rigged, with guns on board, and in heavy sea-going trim. The day was fine and the sea smooth, with a wind from west-south-west, with a force of from 3 to 5. The trial, which occupied about six hours from the time the vessel left her moorings till her return, was satisfactory. The "Arethusa," with her sister competing vessels the "Constance" and the "Octavia," will, it is said, shortly be placed in commission.

STEAM ON CITY RAILROADS.

It is announced, in one of our contemporaries, that six "dummy" engines are building for a street railway in Philadelphia, and but a short time ago we saw mention made of another enterprising corporation that had determined to adopt steam in lieu of horse-power, and thereby save themselves and the public both time and money. It is almost useless to expect anything of our railroad authorities in this respect; notwithstanding all the examples set before them, the arguments in favour of the steam system, and the evidence of common sense, we will still have to put up with horse-power; and the only dummies in use or in existence on our street railroads seem to be those persons who direct and control the principal interests of them.

The gridiron railway, in spite of the outcry and opposition manifested towards it, is gradually extending its iron arms, and even now grasps by far the greater part of the city streets occupied by vehicles devoted to passenger traffic. We had hoped that the directors of these roads would have seen fit to try at least one of the steam cars (they are *not* "dummies"), and compare the cost of running it with that of horses in all essential points; thus to satisfy themselves by practical demonstration that steam is better than horse-power for the purpose discussed. In this we have been disappointed, and horses rule the road, to the exclusion of machinery, which is obviously cheaper than any other means of transportation.

It would be considered fatuitous and short-sighted to the last degree for any railroad company to discard all its engines, run a canal alongside the line, and put on a number of boats and horses to "accommodate freight;" yet this the street railways do, in effect, by employing horses to accomplish tasks that properly belong to machinery. Even in the absence of any positive data in black and white as regards the expense of the two systems for carrying passengers by steam or horse power, it is safe to assume that the former is the most preferable in all respects, on the general ground that the introduction of machinery inevitably enhances the profits of any trade or business, provided the same be properly carried on.

There is no occasion, however, to presuppose that railroad men are ignorant of the comparative economy of steam as opposed to horse-power, and we must seek for some other motive for their non-adoption of the first. Certainly no unprejudiced person could hesitate to declare in favour of steam; the arguments published from time to time in the *Scientific American* (which have never been refuted in the slightest particular) show conclusively that the advantage is in favour of steam. We can only await the slow dawning of intelligence and enterprise upon the minds and convictions of our railroad men; for the pressure of public opinion and the examples of the directors of street railways in other cities seem thus far to have had very little effect.—*Scientific American.*

GREAT TELESCOPE AND PHOTOGRAPHS OF THE MOON.

The American *Journal of Photography* contains a very full report of Henry Draper's Paper recently read before the American Photographical Society on his new telescope, and the large photographs which he has taken of the moon. In the Paper it is stated that, in the autumn of 1858, Dr. Draper determined to make the largest reflecting telescope in America, the construction of which, with various improvements introduced, have occupied his time up to the present period—more than five years. This telescope is nearly 16 in. in aperture and 13 ft. in focal length, and was intended to be devoted to celestial photography; consequently it has many novelties fitting it for this purpose. It has the largest silver reflector of any instrument in the world, with the exception of the one in the Imperial Observatory at Paris. A reflecting telescope is greatly superior to an achromatic one for photographic purposes. Dr. Draper first used speculum metal for his mirrors, but abandoned it at Sir John Herschel's suggestion in favour of silvered glass; the reflecting power of the latter being 93 per cent.; that of the former being but 75. The glass mirror also only weighs 16 pounds, whereas one of the same size of speculum metal weighs 138 pounds; and if the silver of the glass should accidentally be injured, it may be dissolved off by nitric acid and the mirror may be re-silvered in the course of a few hours. This may be repeated an indefinite number of times. The mirror of this telescope has cost Dr. Draper an immense amount of toil, in order to reach as nearly as possible to perfection. He ground more than one hundred mirrors of different sizes, from 19 in. to one-quarter of an inch in diameter. The mirror of this telescope is sustained in a walnut tube hooped with brass, and the frame in which it is mounted holds it at both ends, to avoid the tremulous motion so common to large instruments. When photographs of the moon are being taken, the telescope is not driven by clock-work, but is allowed to come to complete rest; the sensitive plate alone is moved in a direction and at a rate to correspond with the moon's motion. By this mode of operation, only one ounce instead of half a ton is moved. The observatory of Dr. Draper is situated at Hastings, N.Y., on a hill 250 ft. above the level of the sea. The dome which covers it is 16 ft. in diameter, supported on a point at its centre, and can be turned with a gentle pressure of the hand. This instrument can be directed to an object, shifted, and the observer himself moved to any part of the building, by a very slight exertion. A photographic laboratory is attached to the observatory. It contains all the requisite conveniences for taking photographs up to sizes of 3 ft. in diameter. One of 3 ft. and one of 2 ft. in diameter of the moon have been taken. The former represents the moon on a scale of 70 miles to the inch; the latter—2 ft. picture—is the largest that had previously been made anywhere. Celestial photography is, as yet, only in its infancy; but it is progressing rapidly.

THE IRONWORKS OF SOUTH WALES.

As an indication of the improvement which has taken place in the iron trade of South Wales, it may be mentioned that nearly all the works that came to a standstill during the depressed times of the last four years are now either in work or preparations are being made to commence operations. This gratifying state of things has been brought about by the advance in the price of iron and the good prospects of the future. Messrs. Weston and Grice, of West Bromwich, have commenced working at Cwmbran, and a considerable quantity of iron has been already turned out. The Varteg and Golynos furnaces have been blown in by Messrs. Partridge and Jones and Messrs. G. E. Bevan and Co., and part of the Llanelly works, Breconshire, has been converted into a tin-plate manufactory by Messrs. Jayne and Meadhouse. A number of first-class capitalists have also formed themselves into limited liability companies, with the view of working the Pencoed furnace, Pontnewynydd forge, and Penydarren works, together with three or four collieries. Several other smaller works are about to be resuscitated after a long standstill, and the iron trade generally shows a decided improvement as compared with what was the case twelve or eighteen months ago. Employment is plentiful, and, in fact, a scarcity of hands is felt at several of the works.

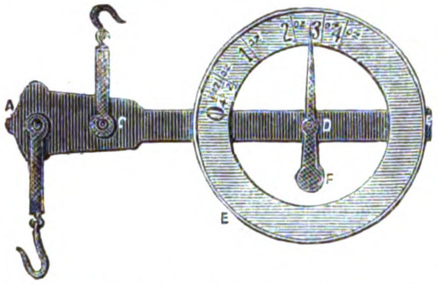
CHARING-CROSS RAILWAY.

On Tuesday, at 2 p.m., the first train passed over the Charing-cross Railway from London-bridge to the new station, now nearly completed, on the old site of Hungerford-market at Charing-cross. The train consisted of two of the heaviest new engines of the South-Eastern Railway, and a large number of carriages of different classes. Mr. Hawkshaw, the engineer of the railway, rode on the first engine, with Mr. Teuton, one of the directors; Mr. Smiles, secretary of the company; Mr. Eborall, general manager of the South-Eastern Railway Company; Mr. Wythes and Mr. Cochrane, the contractors; Mr. Ashcroft, Mr. Knight, and other South-Eastern officials. The trip proved entirely satisfactory; and after inspecting the station at Blackfriars, and the works at Charing-cross, the train returned to London-bridge. It is expected the line will be opened for public traffic in a fortnight.

HALL'S IMPROVEMENTS IN WEIGHING APPARATUS.

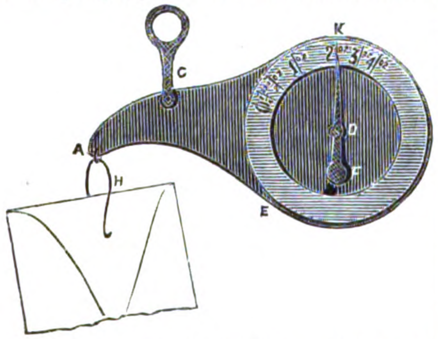
This invention, recently patented by Mr. N. R. Hall, of Rosherville, is on the principle of the common steelyard, inasmuch that the article to be weighed is suspended at the short arm of the the lever, but differs otherwise; for, instead of ascertaining the weight of an article by shifting or sliding a given weight upon the long arm until it is perfectly horizontal, the patentee allows his weighing apparatus to come to rest in any position, according as the weight of the article may draw it more or less from the horizontal line, and then discovers the weight of the article sought by means of a hand, which points to various figures representing weights, which figures are marked upon a circle, at the extremity of one end of the weighing apparatus; at the centre of this circle or dial the hand moves or plays freely upon a stationary pin, and the hand having a heavy tail end, it will always maintain a position when in use, and will therefore be directed to that number which is brought to a vertical position with the centre of the circle or dial. At the proper end for attaching the article to be weighed there is a suitable clip with hooks (or any convenient contrivance may be used for attaching the article to be weighed), and when this weighing apparatus is hung or held up for use with the article properly suspended, the circle or dial will rise more or less, and one of the numbers marked upon it will be brought to a vertical position, to which number the hand will be directed, and thereby indicate the required weight of the article.

Fig. 1 shows the common steelyard, where from A to C is the short arm of the lever or beam,



and from B to C is the long arm; but, instead of a weight shifting or sliding upon the long arm, the long arm is enlarged sufficiently to inscribe a dial of any suitably sized circle; E, a part of a circle upon it, with its centre D, at which the hand F plays freely upon a pin. This diagram is intended to set forth the application of a circle, or part of a circle, upon the long arm of the common steelyard.

Fig. 2 sets forth the general appearance of the weighing apparatus with its circle or dial E



and hand F on the pin D. The article to be weighed is seen at G, representing a letter grasped by the clip H hanging from the point A. The dial E is raised, and the vertical number indicating the weight of the letter seen at K, to which the hand F (from its construction, before described) is directed when the apparatus is hung or held up by the handle at the fulcrum C. The ... hts expressed from one quarter of an o... unces upon the circle or dial of e... drawing, do not confine or limit his invention only to those weights, for by changing the fulcrum point, or making the apparatus of various sizes, it becomes applicable to a variety of weights, which said weights can be expressed or set forth upon the circle or dial; and also for some purposes of weighing there can be numbers, letters, or words representing various charges or prices exhibited upon the circle or dial, so that articles which bear a certain scale of charges or prices according to their weight can have such charge or price readily ascertained.

BRIGHAM AND BICKERTON'S REAPING AND MOWING MACHINES.

FIG. 1

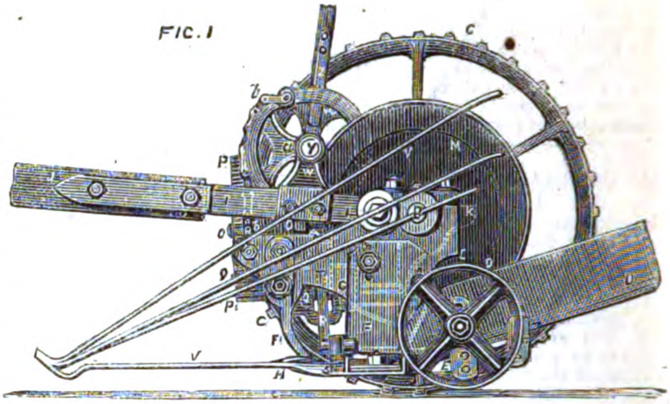
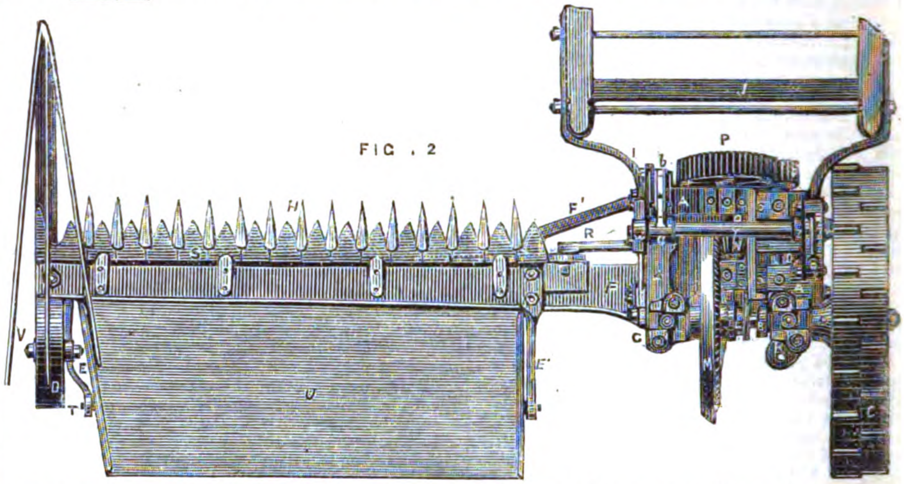


FIG. 2



BRIGHAM AND BICKERTON'S IMPROVEMENTS IN REAPING AND MOWING MACHINES.

This invention, patented by Messrs. Brigham and Bickerton, of Berwick-on-Tweed, relates to the arrangement and construction of certain parts of machines used for reaping or mowing purposes. Under one modification or system of arrangement, the frame for receiving the main spindle and the operating gearing is cast in one piece. This frame consists mainly of a bracket piece extending across the machine, and on the upper part of which are two tubular bearings through which the main spindle passes. The outer end of this spindle projects sufficiently to admit of the bearing wheel being fitted thereto; on the other side of the machine it is supported by a small wheel carried at the outer end of the finger bar, which part of the machine is bolted to a pendent prolongation of the main frame before referred to. On the main spindle which is carried round with the motion of the driving wheel is a bevel wheel; this wheel is keyed to a short horizontal shaft, arranged longitudinally in the centre of the machine. On the forward extremity of this shaft is a spur wheel, which gives motion to a pinion on the contiguous crank shaft; this shaft is connected by a rod to the cutter bar, and communicates a rapid reciprocatory movement thereto. The cutter bar has arranged in connection with it a lever, by means of which it is readily adjusted to the required height.

Under one modification or system of arrangement of this part of the machine, a bracket-piece is affixed to the framing of the machine, and from the upper part of this bracket-piece extends an open frame of a segmental figure. There is an opening between the segmental plates of this frame to admit of the motion of the hand lever, by means of which the cutter bar is raised or lowered, and on the inner side of the outer standard of the frame a series of ratchet teeth are formed, to admit of the hand lever being fixed at any desired elevation. Through the central part of the segmental frame is passed one end of a horizontal shaft which extends across the machine, the bearings of the spindle being arranged in the frame and in a suitable bracket on the opposite side. The hand lever is keyed to the shaft before referred to, and extends outwards beyond the segmental frame to within convenient reach of the driver. On the outer side of the hand lever is fixed a blade spring, which takes into the ratchet teeth on the segmental frame, and so retains the hand lever in position. At one extremity, or other suitable part of the horizontal shaft, is keyed a segmental pulley, to which is fastened one end of a piece of chain, the other being connected to the cutter bar. With this arrangement the cutter bar is most readily adjusted to any required height suitable for the crop to be cut, by a simple upward or downward movement of the hand lever, and requires no further attention until the re-adjustment of the cutter bar is necessary.

Fig. 1, in the accompanying engraving, is a side elevation of the main portion of a reaping or mowing machine, arranged according to these improvements; and fig. 2 is a corresponding plan of the same,

The frame A of the machine is formed of cast iron, and consists of a single piece, formed of a suitable shape, to receive the shafts and other working gear or parts requiring to be attached thereto. On the upper part of this frame depressions are made to receive the bearings of the main driving shaft B; or in lieu of the bearings being fitted with covers as shown in the drawings, two tubular bosses may be formed in the frame for the shaft to work in. On the outer end of the shaft B is keyed the wheel C, which forms the principal bearing and driving wheel of the machine, the motion of which drives the other moving parts of the apparatus. The other side of the machine is supported by the smaller bearing wheel D, the adjustable supporting stud of which is carried in the bracket E that is bolted to the finger bar F; the other end of the finger

bar is bent upwards and attached by the bolts to the bracket G, and secured to the side of the frame A, and further secured by the strong angular stay F^1, the front part of the bar being furnished in the usual way with the fingers H for dividing the standing crop. To each side of the frame A is hinged and secured a strong knee-piece or bent arm I, and to these knee-pieces is attached the front frame J, the side pieces of which form the horse shafts. An eye is formed at K in a backwardly projecting part of the frame A, which is intended to receive the lower end of a bent rod carrying the seat for the driver. On the shaft B is a coupling L, by means of which the motion of the shaft is communicated at will to the bevel wheel M, fitted loosely on the shaft B, the hand lever for operating the coupling L, being of the usual construction, is not shown in the drawings. This wheel gives motion to a pinion N carried on the shaft O, which is arranged in a slightly angular position, the bearings being carried in parts formed for the purpose in the frame A. On the front end of the shaft O is a spur wheel P, which drives a pinion P^1, keyed on the outer end of the crank shaft Q. The crank of this shaft is connected by the rod R to the cutter bar S, which thus receives its reciprocatory movement from the crank. The brackets E and E^1 are attached to the finger bar F, the extremities are enlarged laterally, and have holes made in them to receive and admit of the adjustment of the end journals T, which partially support and regulate the angle of the platform U, on to which the cut crop falls. At the outer side of the machine, contiguous to the wheel D, is a guard V, which serves to divide the standing corn and direct it inwards towards the fingers H of the bar F. This machine is also provided with an improved arrangement for regulating the height or distance of the finger bar from the ground, so that it may be adjusted to suit the crop to be cut as well as to keep it clear of any inequalities of the soil. To the sides of the malleable iron knee-pieces I, are bolted the bracket bearings W and W^1; the bracket W is cast in one with a double segmental piece, so as to admit of the lower part of the hand lever X passing between the faces of the segments. The lever X is keyed to the transverse shaft Y, which is carried in the brackets W and W_1, and the lever has formed on it a small laterally projecting pawl or tooth, which takes into the ratchet teeth that are formed on the contiguous face of the segment. The lever is kept in gear with the ratchet teeth, when not otherwise acted upon, by means of the blade spring Z, which presses against the opposite face of the segment. On the other end of the shaft Y is fitted a segmental pulley a, to which is attached one end of the chain b, whilst the other end is fastened to the front part of the frame A. When the driver is seated on the machine, the lever X is within convenient proximity to his right hand; and when he desires to raise the finger bar F, he simply draws the lever X backwards towards him; but when he has to lower it, the lever has to be drawn to one side, so as to release it from the ratchet teeth, then move it in a forward direction to the extent that he requires the finger bar to be lowered. When the lever is released, the spring Z presses the pawl on the lever into the ratchet, and the lever is retained in that position. The partially rotary motion of the shaft Y raises or lowers the chain b, and with it the front part of the machine, bringing the finger bar to the required height, and thus adjust, the cutters to suit the crop to be operated upon.

The arrangement of the adjustable lever is applicable to other kinds of reaping or mowing machines, as well as the particular modification hereinbefore described and shown in the accompanying drawings—as, for example, in applying this arrangement to the kind of reaping or mowing machine known as the "Buckeye reaper," the shaft Y is arranged across the carriage of the machine, and the free end of the chain b is attached directly to the finger bar. With these improvements, reaping or mowing machines are rendered stronger and more compact, whilst the adjustment as regards the height of the finger bar is more readily effected.

LAKE SUPERIOR COPPER WORKINGS.

A LARGE and most interesting pamphlet, by Charles Whittlesey, Esq., "On Ancient Mining on the Shores of Lake Superior," has been published, in New York, as one of the Smithsonian contributions to knowledge. The author has devoted much attention to this subject; and maps of the country, with engravings of old mines and the relics found in them, are contained in this publication. We here learn that evidences of ancient mining operations were first brought to public notice in the winter of 1847-8. The Jesuit Fathers who first visited that region announced the presence of native copper in large masses; and boulders of copper had been found many years ago scattered among the drift gravel, from Lake Superior to Rocky River in Ohio; but no ancient workings were known till the period mentioned above. In casting the eye over a map of Lake Superior, a remarkable projection in the form of an immense horn, is observed jutting out from the south shore and curving eastward. This is Keweenaw Point, which is about 80 miles in length and 40 in width. Through the whole of this extent of projection, a belt of metalliferous formation extends; and within this all the copper mining operations—ancient and modern—have been contined. The most remarkable feature of this metalliferous region is the character of its products, which occur, not as an ore of copper, but in masses, veins, and rounded nodules of the metal itself.

The first actual mining operations here were commenced in 1761 by Alexander Henry, but they proved abortive. In 1841, Dr. Douglas Houghton made a report to the Legislature of Michigan, conveying very definite information respecting the existence of native copper in Lake Superior; and shortly after this, fresh mining operations were commenced, and speculators flocked in from all quarters. In 1848, Mr. S. O. Knapp, agent of the Minnesota mine, made the first public announcement respecting the discovery of ancient mines and the relics of an ancient mining population. This created a sensation far and near, and subsequent explorations have led to the discovery of very many ancient pits. Most of the ancient diggings have been found in dense forests, and outwardly consist of irregular shallow hollows, which had been previously noticed without thought of their real character. There are three groups of ancient mines corresponding with the modern mines in this region. In these old pits, hard stone malls and hammers have been discovered; also copper hammers, spear heads, gads, arrow heads, and knives; and wooden shovels, levers, and a ladder. During the past summer, several of these old mines were discovered in the Ontanagon district, and from one a bag of untanned leather in a perfect state of preservation was taken, and has been considered one of the greatest of ancient curiosities. Who these olden miners were, is a puzzle to antiquarians. But providentially they have done great service to us, for our practical modern copper miners regard the old pits as pretty sure guides to valuable copper lodes. When an old pit is found, it is cleared out and explored, and generally the miners are rewarded by finding rich masses in the excavation. These ancient miners seem to have possessed quite as accurate a knowledge of the copper veins as the most skilful and intelligent modern mineralogists and miners. In a certain sense they were our mining pioneers. They do not seem to have been acquainted with the art of smelting copper, and were unacquainted with the use of iron; therefore their efforts at mining were rude; still they have left evidences of being an ingenious and skilful people. Mr. Whittlesey entertains the opinion that these ancient miners were not of the present Indian race. As yet no remains of cities, no graves, no domiciles or ancient highways have been found in the copper region. These old miners appear to have been further advanced in civilization than those whom we call aborigines. Trees standing upon the old pits are about 300 years old, and beneath these lie the rotten trunks of a still earlier period. When the ancient miners lived is unknown; but these mines must have been abandoned at least from 500 to 600 years preceding the present age. Who they were, where they came from, and whither they went, in all likelihood, will never be known.

The copper mining business in the Lake Superior region is in a very prosperous condition at present; and we learn, from the *Mining Gazette*, that a new copper-smelting establishment is now in operation on Portage Lake; which, with the one recently erected in California, will make eight now in operation in the United States.

VENTILATION OF MINING TUNNELS.

A MOST important feature of the expense of mining tunnels of any great length in America has heretofore been absorbed in the supposed necessity for sinking air-shafts every few hundred feet. We have frequently alluded to the bad management, or rather, lack of knowledge of the principles of ventilation in underground operations, both in driving tunnels and in drifting perpendicular openings, or shafts. A late number of the Virginia City *Union* gives the following very good plan recently adopted at the famous Latrobe tunnel, in Virginia City:—

When this tunnel had reached a length of only a few hundred feet it was found necessary to sink an air-shaft, and at F-street another; at this point the bottom of the shaft was closed up, with the exception of a hole about 10 in. square, through which passed a wooden box flue of that size, by which the air is conducted into the further extremity of the tunnel. The draught is so strong, that, notwithstanding the tunnel is west of A-street, no other shaft has yet become necessary, and it is thought that no more will be required, as it will be but a short time before it connects with the works on the Comstock. A candle held at the mouth of the flue will be instantly extinguished. Throughout the whole of the great distance which this flue supplies with air, the tunnel is cool and pleasan, and a person can breathe with almost as much easte as in the open air. This plan of ventilation was first suggested to the superintendent of the tunnel, we understand, in reading the translation of an old German work on mining.

The Latrobe tunnel is now in about 2,600 ft., and is in daily expectation of reaching the ledge (Comstock), which it will strike at a depth of 465 ft. from the surface.

The Santa Fé mine, also in the Virginia City district, is ventilated on a similar principle. A tin tube, some 4 in. in diameter, is connected with a tall wooden flue, standing in and reaching to the surface of an air-shaft, and running back from the bottom of the shaft to the furthest end of the tunnel, where the drifters are employed.—*California Mining Journal.*

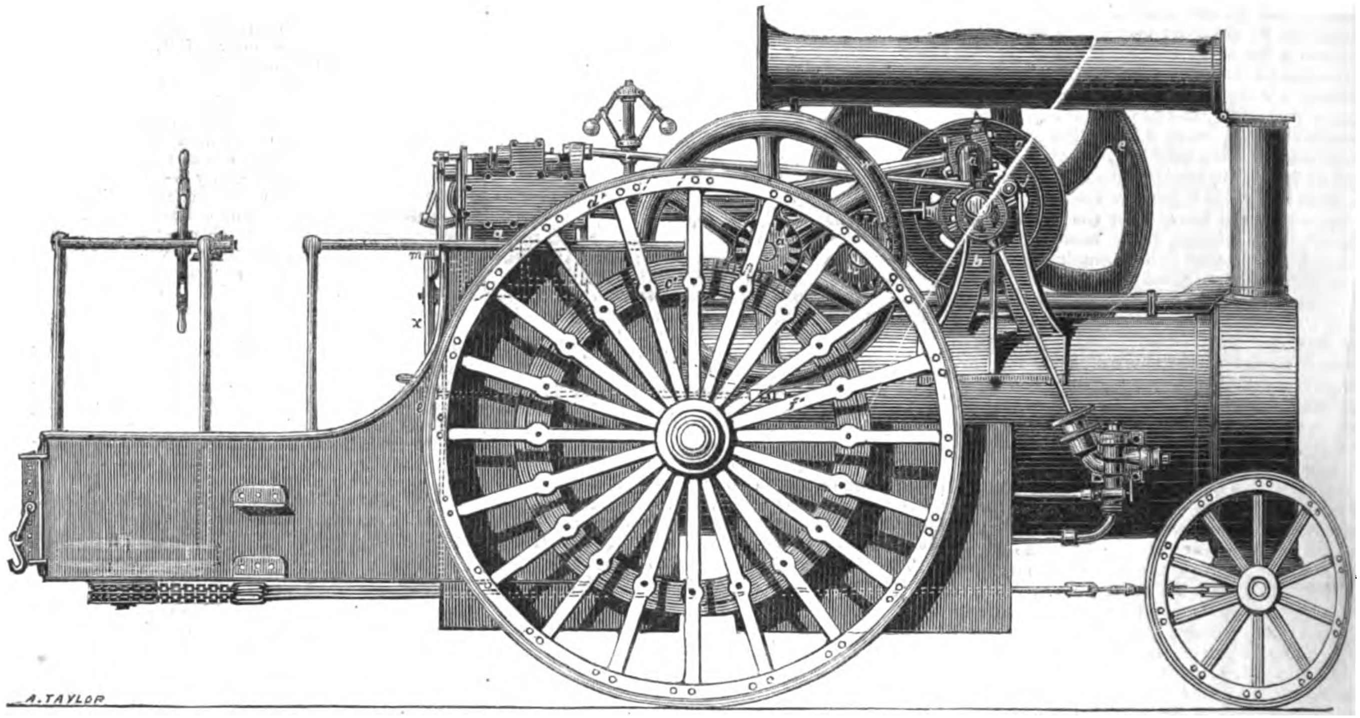
PHOTOGRAPHY BY THE AID OF ARTIFICIAL LIGHT.

A FRENCH *savant*, M. M. A. Gaudin, has invented a new lamp, by the aid of which the photographer can employ the hours after sunset in multiplying negative copies from the positive pictures obtained during the day. A light of the kind required has long been sought for, even before the art of photography was understood, for the purpose of lighting ships and signalling.

Oxygen, expelled from a receiver by any convenient degree of pressure, passes into a receptacle containing ether, or some spirit rich in hydrogen; on issuing from this it will, if ignited, burn precisely like alcohol. If, however, we cause the saturated gas to mingle with a stream of pure oxygen, flowing from the first-mentioned receiver, the force of the currents being regulated by suitable stopcocks, the jet of flame impinging on a cylinder of lime produces an intense light, resembling Drummond's in every particular. M. Gaudin's experiments are very interesting, as they apparently supply us with a means of obtaining the Drummond light with oxygen alone, thus obviating to a great extent the risk which has hitherto attended the use of that light. We much fear, however, that the high price of oxygen gas must, except in exceptional circumstances, preclude anything like a general adoption of the invention.

The trial of a newly-invented lamp for lighting railway platforms, goods' stations, &c., took place on Friday evening last, at the Devonshire-street depôt of the Great Eastern Railway. There were present Captain Belfield and Captain Martindale, who attended by order of the Secretary of State for War, and representatives of all the principal railways which run into London. The yard of the depôt in question is about a quarter of a mile in length, and, although four of the new lamps are erected, only two were used. The light from them was found amply sufficient to enable the workmen in every part of the yard to dispense with the ordinary hand-lamp hitherto in use. Indeed, such was the illuminating power of the light that small print could be read with facility at a distance of 45 yards, and the scientific men who witnessed the effect expressed their entire satisfaction with the result of the trial. The lamps are constructed and fixed upon the principle invented by Dr. Brown, late of the Royal Navy, and are already in general use on the Great Eastern Railway.

BIDDELL'S TRACTION ENGINE.



BIDDELL'S IMPROVEMENTS IN TRACTION ENGINES.

THESE improvements, patented by Mr. George Biddell, mechanical engineer, Ipswich, consist in the application and use of a friction clutch or clutches in combination with suitable driving and disengaging gear. The piston rod of the steam cylinder gives motion to the main or crank shaft, on which the friction clutches are by preference placed, although they may be placed on an intermediate shaft, one part having a sliding motion thereon, but always turning with it, whilst the other part which carries a toothed wheel is capable of turning thereon freely when the two friction clutches are not pressed together. On the main or crank shaft is a fly-wheel. The toothed wheel carried by the friction clutches gives motion to another toothed wheel fixed on a second shaft, on which second shaft are two toothed pinions which turn with but can slide on that shaft; these pinions are coupled together by a double crank, connecting rods, and forked levers, or other suitable contrivance, in such manner that when one is moved out of gear with its wheel the other is moved into gear with its wheel. The crank by which these two pinions are slid, is on a separate shaft having a lever handle thereon, by which it can be turned in one or other direction at pleasure, and by the interposed mechanism slide the two pinions. One of these toothed pinions works in the teeth of an internal wheel, whilst the other works in the teeth at the periphery of a wheel of lesser diameter, but both these wheels are fixed on the same shaft. There are also two toothed pinions on this axle or shaft, which rotate with, but are capable of sliding on, the ends of this shaft or axle, so that either or both of such pinions may be in or out of gear with spur wheels carried by the two main road wheels.

These improvements give increased facilities in working; they do away with the usual reversing slide gear, and admit of a single cylinder engine being as efficiently used as one with a double cylinder, thus giving greater simplicity and economy, as also less wear and tear.

The accompanying engraving, represents a side elevation of a steam traction engine, combined or arranged in accordance with these improvements. *a* is the steam cylinder of the engine, firmly attached to the boiler and connected with the crank shaft brackets *b*, *b*, by the two stay bolts *c*, *c*. Motion is communicated to the crank shaft *d* from the piston by its rod and connecting rod in an ordinary manner, there being guide bars, cross-head, slide valve, eccentric, and parts in connection therewith, also a governor, throttle valve, starting valve, and feed pump—all which are arranged as heretofore. The starting gear, worked by a man at the back of the engine, is of the usual kind, and needs no description. *e* is the fly-wheel on the engine shaft; *f* is a small pulley fixed at the end of the crank or engine shaft, both of which can be used for driving suitable machinery when required, as by an ordinary portable engine; *g* is the external part of the cast-iron friction-clutch, having a cog wheel *h* securely bolted to it. Upon the largest diameter of this part of the clutch a wrought-iron hoop is shrunk to give additional strength. This portion of the clutch, with its cog wheel *h*, is free to turn upon the engine shaft, except when the other portion of the clutch is pressed into it, when it must revolve with that shaft. The whole clutch is kept in its position endways on the shaft by fixed collars. The internal part of the clutch is provided with its six sets of radial knuckle joints and screws and adjusting nuts. This portion of the friction-clutch is always obliged to rotate with the crank shaft of the engine, being carried round by a key, but is capable of sliding endways. The hand wheel *m* gives motion to a screw through the small pair of bevel wheels, which screw acts directly upon a forked lever, which receives two projections of a collar (made in halves) spanning a recess in the boss of the part *i* of the friction clutch. By these means the friction surfaces of the clutch can be brought into powerful contact or released with perfect command, thus communicating motion to the gearing at pleasure, whilst the engine is running, and without the necessity of stopping the engine shaft and piston. *r* is a cog wheel fixed to its shaft *s*, gearing into the wheel *h*. The shaft *s* carries two pinions *t* and *u*, which always turn (by means of proper keys) with the shaft *s*, but are capable of sliding upon it, so as to be put in and out of gear with their respective wheels *v* and *w*, by means of the handle and rod *x*, and a proper arrangement of levers, cranks, and rods, which arrangement is to be such that the two pinions *t* and *u* shall not possibly be both in gear or in action on their respective wheels at the same time. By one action of the handle *x* and double crank *y*, one pinion is always fairly withdrawn from acting on its wheel before the other pinion enters into gear or acts on its wheel. The wheel *v* and internal wheel *w* are both firmly fixed to the shaft *z*, upon which also there are two pinions, which are made to turn with this shaft, but are capable of being moved endways upon it by means of forked levers, so that they can at pleasure be easily engaged or disengaged with their respective wheels, which are firmly attached to the main road or driving wheels. Upon the exterior circumference of the internal wheel *w* a single clip break is arranged, which is operated upon by means of a hand wheel, and a right and left hand screw.

It will be readily seen that, by means of the friction-clutch and the arrangement of the gearing and the disengaging levers and rods as described, whilst the engines, piston, and crank shaft are running, the forward or backward motion of the entire machine can be started, stopped, or reversed at pleasure without stopping or reversing the motion of the engine shaft and its fly-wheel, thus giving increased facilities and obvious advantages in using the power of the engine.

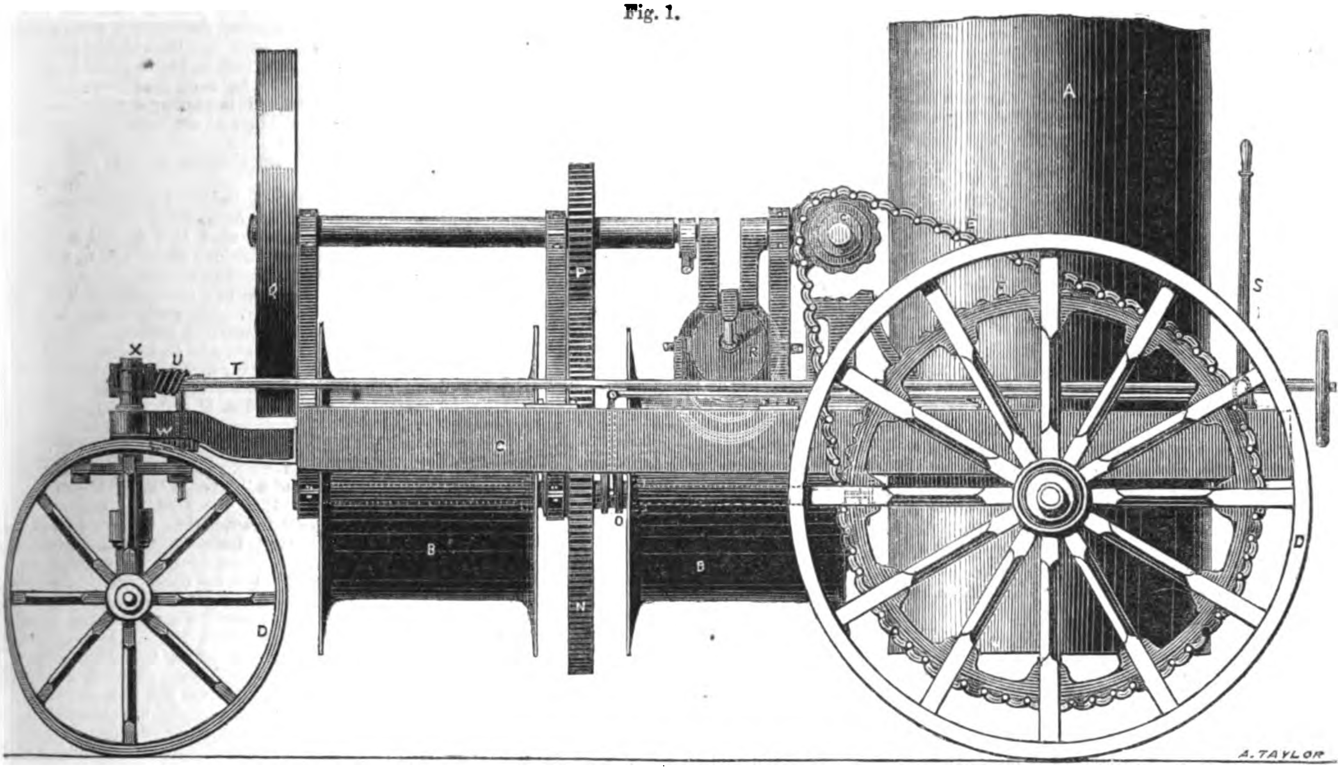
F. AND A. ROBERTS' IMPROVEMENTS IN AGRICULTURAL IMPLEMENTS.

THIS invention, patented by Messrs. F. and A. Roberts, of Gloucester, comprises various improvements in agricultural implements, and in apparatus for working the same, being more particularly designed for application in the cultivating system, wherein two reversed sets of ploughs or other agricultural implements are drawn backwards and forwards between a steam engine and a stationary pulley or anchor, or two steam engines, or two anchors, some of the improvements being also applicable otherwise.

In one modification of the portion of the improved arrangements in immediate connection with the ploughs or implements there is centrally a kind of carriage or framing resting upon three wheels, which are adjustable as to height, one of which (a large one) runs in the furrow on one side, whilst the other two (being small ones) run on the land or top surface on the other side. A barrel is mounted loose on a transverse horizontal shaft forming part of the carriage framing, and at opposite ends of this barrel there are discs or

F. AND A. ROBERTS' AGRICULTURAL IMPLEMENTS.

Fig. 1.



levers, to the opposite points of which are jointed the inner ends of two frames, having the ploughs or other implements attached to them. These frames lie in opposite directions, and when the barrel is turned to place one frame in its lowest position the other frame will be in its highest position. The outer ends of the plough or implement frames are formed with sockets, through which pass vertical spindles fitted with swinging or castor wheels at their lower ends, and the outer frame ends are moved up or down these spindles simultaneously with the upward or downward movements of the inner frame ends by means of ropes led from the barrel to pulleys at the heads of the spindles; or other equivalent mechanical means, may be adopted to keep the plough or implement frames parallel, or nearly so, whilst being moved up or down. The draught of the hauling rope is made to draw down the proper plough or implement frame into its working position at each traverse, and for this purpose there is upon the barrel a double-grooved pulley or sheave, which can be put into or out of gear with the barrel by an ordinary clutch and lever. The rope ends are attached one to each part of the pulley, both ends being led upon it underneath. With this arrangement it follows that when one rope (that to the right, for example) is hauled tight, the barrel is turned down on the left-hand side, putting what is then the after set of ploughs or implements down into their acting position, the strain being applied in a very effective way for forcing the ploughs or implements down into the soil. To facilitate the shifting of the apparatus at the headlands, and otherwise, the central carrying wheels are made to swivel for steering purposes. In a simple arrangement for steering these wheels a bevelled tooth sector is fixed on the vertical spindle of the large wheel, this sector being connected by cross links to levers on the vertical spindles of the two wheels on the opposite side. The toothed sector is acted upon by a bevel pinion on a spindle fitted with a hand wheel. Other implements instead of ploughs may be attached to the frame.

In one modification of the portion of the improved arrangements relating to the haulage of the implements, a steam boiler (vertical by preference) is employed to admit of the hauling or winding drums being conveniently mounted independently of it, but on the same framing. The framing is (by preference) rectangular, and the boiler is placed at one end between the main driving wheels. At the other end there is (by preference) a pair of smaller wheels arranged with swivelling gear for steering purposes. These wheels may also be arranged to rock, so as to accommodate themselves to inequalities in the ground surface. The winding drums are mounted on a horizontal shaft disposed longitudinally, and the first motion shaft is placed in a parallel position above. The first motion or crank shaft is actuated (by preference) by two steam cylinders placed above one of the drums, and the drums are actuated by a pinion on the first motion shaft in gear with a spur wheel on the drum shaft, a clutch or clutches being provided for throwing either drum into or out of gear. For actuating the driving wheels, toothed rings or wheels are fixed or formed on the inner faces thereof, and these toothed rings are encircled by endless chains driven by toothed pinions on a transverse horizontal shaft, receiving motion from the first motion shaft by means of three bevel wheels with clutch for giving motion in either direction. On the end of the first motion shaft there is a fly-wheel shaped to act as a driving pulley when it is wished to employ the engine for actuating thrashing or other machines. The framing may be continued beyond the boiler to support a water tank and coal box and a platform for the driver; the framing also may be made hollow, so as itself to form a tank, if preferred, and the various levers for controlling the working of the engine may be arranged conveniently to the driver's hand. The anchor, with guide pulley for the headland opposite to that at which the engine is placed, consists simply of a kind of triangular or other form of frame mounted on three or four wheels, one or two whereof being arranged to swivel for steering. The guide sheave or pulley is on the lower end of a vertical spindle hung in bearings on the frame, and on the upper end of this spindle there is a bevel wheel in gear with another bevel wheel on a short horizontal spindle, with clutch for putting them into or out of gear. The horizontal spindle has a pinion on one end, which gears with a toothed ring or wheel fixed or formed on the inner face of one of the carrying wheels, and by this means the anchor is rendered self-moving. The axle of the main carrying wheels may be shifted upon the frame in order to lift the guide pulley or sheave higher off the ground when travelling. Flange pieces are provided to bolt to the wheels for the purpose of penetrating the soil, and so resisting the lateral strain on the anchor. The parts of the apparatus may be combined in various ways besides that described; thus one plough frame or different implements may be attached directly to the engine which may itself be made to traverse backwards and forwards over the ground, and in this case the winding drums may be removed from the engine if wished.

Fig. 2, the accompanying engraving, is a cross

Fig. 2.

section or end view of a set of ploughs with one frame removed.

The parts marked with the letter A are the frames which carry the ploughs or other tilling tools or implements, or to which they are attached; B are the wheels on which the apparatus travels; C are the discs on the ends of t

barrel to which the frames are attached, and by which the implements are raised from and lowered to their work; ropes or chains pass over or around one of the discs, and under pulleys in the ends of the frames, and are attached to loops on the top ends of the vertical spindles of the castors or end wheels; F is the barrel, which runs loose on a transverse spindle or shaft G, to which also are attached the bearings K for the axles L of the carrying wheels; H is a circular piece with two grooves, to which the draft ropes are attached, which also forms a clutch or catch box capable of being moved on the barrel by means of a lever I, hinged in cross bars g attached to the axle bearings. This clutch runs loose on the barrel, except when moved into contact with a corresponding clutch F^2 formed on the barrel. The wheel axles L are vertical at the fixing part, and pass through bearings K attached to the ends of the shaft G. These axles are capable of swivelling for the steerage of the apparatus by means of a bevelled toothed sector M fixed on the top of one axle gearing with a pinion fixed on a shaft N, on which is a hand wheel O. Levers are also fixed to the axles, and connected with each other by rods, so that in turning one axle by the hand wheel all the axles will thereby be turned, and the wheels thus swivelled. The height of the carriage from the ground, or the depth to which the ploughs or implements are required to penetrate the ground, is regulated or adjusted by means of nuts screwed on the vertical parts of the axles.

Fig 1 is a side elevation of the combined engine and windlass. A is the boiler, and B, B, the winding drums carried by the same frame or carriage C. The frame C may be constructed so as to form a water tank for the supply of the boiler. D, D, are the travelling wheels, the front or smaller ones being made to rock and swivel, a method of steering them being hereinafter shown. E are the toothed rings or chain wheels fixed on the travelling wheels, encircled by chains F passing over the pinions G, carried by the cross shaft H. This cross shaft also has two bevel pinions I, which turn loosely on it, and gear with another bevel pinion J, keyed on the crank shaft K. On the shaft H, and between the pinions I, is a clutch L, which is made to slide on the shaft. The clutch has projections at both of its ends, and in the pinions I are corresponding recesses. When, therefore, the clutch is thrown out to the right hand, the right-hand pinion will become fixed on the cross shaft H, and in revolving will of course carry the shaft with it, giving motion to the travelling wheels in one direction, and when the clutch is thrown to the left the same effect follows, only the direction given to the travelling wheels will be opposite to the former. When stationary, the clutch is midway between the pinions I, and the shaft H is at rest. By this arrangement the usual link motion is disponsed with, the engine never requiring to be reversed. M is a lever for throwing the clutch L into or out of gear with one or other of the wheels I. Each of the drums has a suitable rope, to which the plough or cultivator is attached—one of them winding up its rope as the implement approaches, and the other unwinding; and as the implement returns to the anchor, *vice versa*. The drums are not keyed to the horizontal spindle, but turn loosely on it; while at work, ploughing or cultivating, it is necessary at each traverse of the implement, to throw one drum out of gear and the other in. This is done as follows:—The large gear wheel N runs loosely on the horizontal spindle that carries the drums, and a projecting boss thereon, forming a neck, is supported by a bearing on the frame of the carriage, betwixt which and one of the drums is a clutch O, which slides on the spindle and has projections which pass through the boss of the said wheel, and enter the drum when moved in that direction, also having other projections which enter the other drum when moved in the opposite directio[illegible]equently each drum will be thr[illegible] out of gear as the clutch is thr[illegible] left. In this way, on the ploug[illegible]adland, there is no necessity for stopping or reversing the engines. The gear wheel N is actuated by the pinion P keyed to the crank shaft K, on which shaft is the fly-wheel Q, which may be available where not employed in ploughing for giving off the power of the engine for thrashing, grinding, pumping, or any other sort of work required. The shaft K is driven by two oscillating engines fixed on the framing, one of which is shown at R connected to one of the cranks. S is the lever for working the clutch O, and T is a spindle on which is a worm U gearing with a wheel V on a short shaft, on which is a wheel in gear with a sector W on one of the axles of the front wheels, which is connected by rods and levers to the other, whereby they are swivelled, and the engine steered as required. The said front wheels are also capable of rocking or rising and falling, according to the undulations of the ground, by having the axle frames hinged in the middle at X. The framing may be brought back behind the boiler, and made to support a small tender for coal, water, and a platform for the engineman. The engine, windlass, and steering are all managed at the boiler end, as shown. The framing itself may form a tank.

A NEW WANT IN AMERICA.

The following highly suggestive paragraph appeared in the *American Railway Times* a week or two back:—The breaking-up of the system of slave labour in the Cotton States consequent upon the rebellion, opens a new field of experiment for our inventors and mechanics. The cotton, rice, and sugar fields are to be cultivated by free labour, and, as a necessary consequence, by labour-saving tools and machinery. Instead of the scratchy hoe and the mule plough for breaking up the cotton lands, there must and will be steam ploughs introduced and used. The cotton lands are particularly adapted for the use of the steam plough; being mostly quite level, and the soil strong and compact. These lands having been worked for years mostly on the surface only, steam ploughs that will go 16 in. or 18 in. deep, will bring to the surface the elements of fertility so long neglected and unused; and plantations that are now comparatively valueless under the very superficial cultivation of slave labour, can be made mines of wealth to the country. What is now wanted is *the* steam plough that is best calculated for this service. The population for tending and picking the cotton are all on the lands ready for the service, and under efficient steam ploughing and intelligent free-labour culture, the crops may easily be doubled. Who has got the best steam plough?

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—Messrs. S. and Co., J. W., J. H., S. D., J. N., M. L., W. B.

A. Y. (Belfast).—We must refer you to our advertising columns.

D. K. (Wolverhampton).—Certainly electricity and magnetism mutually produces each other.

Shafting (Truro).—You only give the length of your shaft and its diameter; you do not state what the length of your crank is, and therefore it is impossible that we can say what amount of torison is produced by the pressure on your piston.

T. K.—A boiler 4 ft. in diameter, and 5-16th thick, if of fair iron, will stand 60 lbs. strain with ease. We do not approve of angle iron bridge stays across the back plate of a fire-box shell; they usually throw a peculiar and injurious strain on the corners of the plate.

Correspondence.

NEW SYTSEM OF ARMOUR PLATING.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I noticed in your valuable paper of the 13th inst., a description of the American-clad warship, "Dictator," from the designs of Captain Ericsson, and was struck with the similitude that this improved "Monitor" appears to have, with regard to its armour and turret, with Mr. John Walker's floating battery, described in your number of the 25th of July, 1862, and for which he took out, about that time, a patent in England and France.

It may therefore be said, that these improvements were known in this country seventeen months ago; and the first ideas do not come from America, but from England.

Your obedient servant,

A. Ragon.

14, Caroline-street, Bedford-square, London,
November 30th, 1863.

P.S.—I have presented this invention to the French Naval and Military Departments, where it has been most favourably received.

[We willingly give our correspondent's letter a place in our columns. We early traced the similarity between the American system, as applied to to the "Puritan," &c., and that invented by Mr. Walker, who is really entitled to all the credit which can accrue from what seems to us to be a very valuable invention.—Ed. M.M.]

NARROW GAUGE LOCOMOTIVES.

Sir,—Until I read the account in your Magazine of the 27th ult., of a "Narrow Gauge Locomotive," I was not aware that the slightest difficulty had been experienced in supplying the want for these which you indicate. Unless I am much mistaken, there are at least a dozen firms in the country, who might have undertaken the construction of engines for the Port Madoc line without hesitation; and those who are acquainted with what has been already accomplished in the North for colliery and mineral lines, will be surprised to be told that anything novel or extraordinary has been achieved in the case which you mention. I could not have credited that—as stated—the late Mr. Robert Stephenson pronounced upon the impossibility of constructing such an engine as was required, and am tolerably confident that the firm of Stephenson and Co., would for the last dozen years have seen nothing impossible about the scheme; though it might not suit them to undertake the construction of a few such engines. The ingenious juxtaposition of the name of the prejudiced and obstructive Stephenson with that of the clever young gentleman just out of his apprenticeship, would be creditable to the skill of an unscrupulous puffer, but can only excite the ridicule of those acquainted with the past history and present position of Locomotive Engineering.

Your obedient servant,

A.

Meetings for the Week.

Mon.—*Soc. of Engineers*, "Steam Navigation on the Indus," by E. Warren, Esq., at 7.15 p.m.
Royal Inst., General Monthly Meeting, at 2 p.m.
Medical Soc., Lettsomian Lecture, at 8.30 p.m.
London Inst., "On English Costumes from the Anglo-Saxon Period," by Rev. Henry Christmas, F.R.S., at 7 p.m.

Tues.—*Inst. Civil Engineers*, 1, Continued Discussion upon Mr. Morshead's Paper "On Cornish Pumping Engines." 2, "On the Closing of Reclamation Banks," by J. M. Keppell, Esq., at 8 p.m.

Thur.—*Royal Soc.*, at 8.30 p.m.
Antiquaries, at 8 p.m.
London Inst., "On the Principles and Applications of Organic Chemistry," by J. A. Wanklyn, Esq., at 7 p.m.
Inventors' Inst., "On Inventions for Improving Pavements with the view of rendering them clean, durable, and safe," by Robert Saunders, Esq.

Fri.—*Architectural Assoc.*, Prize Essay or Vaulting and Groining, at 8 p.m.

Miscellanea.

Samuel Hall, Esq., C.E., whose name is familiar to almost all connected with engineering science (brother to the celebrated physician and physiologist, Dr. Marshall Hall), died in London a few days ago at the age of eighty-three years. In a list of twenty-one inventions patented by Mr. Hall, we find those for the gassing, starching, bleaching of lace and other fabrics by which his native town of Nottingham and the surrounding country have derived so much wealth and fame. He also devoted a considerable amount of time and money to the improvement of the steam engine, the prevention of smoke and boiler explosions, and was the patentee of the "Surface Condenser" which is now occupying such a large share of attention in connection with marine engineering, and which invention was applied with considerable success by Mr. Hall to the "Sirius," the first steamship that crossed the Atlantic with steam alone.

The "Golden City," a fine American steamer, recently built, has made a remarkable voyage to California. The "Golden City" has an overhead beam, single cylinder engine, of 105 in. diameter of cylinder and 12 ft. stroke of piston, built at the Novelty Iron Works, New York. This new steamer arrived at Panama direct from Rio (not touching, as usual, to coal at Lota), October 24, in 41 days 15 hours running time from Canal-street wharf, New York; whole distance 11,166 miles. The greater part of the Atlantic voyage she experienced head winds with heavy seas. From the Straits to Panama she averaged 305 miles a day, and for the whole voyage 268 miles a day.

We learn that an arrangement has been entered into between the Government and the Montreal Steamship Company, in pursuance of which the latter will receive another contract for the performance of the ocean mail service. The precise rate of payment has not been stated; but it is known to be much smaller than the sum paid under he contract which Ministers abrogated. Care will also be taken so to prepare the agreement that the public shall have stronger guarantees of safety, and of an efficient performance of the mail service, than were formerly provided.

Some time ago a splendid stick of white oak timber was landed at the Globe Works, Boston. It was one of the largest ever brought into Boston. It measured 66 ft. in length, and was hewn up square, on the average, 28 in. by 29 in. It contained 370 cubic feet., equal to 4,440 ft. broad measure, or 9½ tons. Its actual weight would not be less than 12 tons. It was brought from the State of New York.

Captain Alexander Bowers, of the Royal Navy Reserve, has performed an exploit as important, if not as interesting, as the discovery of the source of the Nile. He has taken a 1,000-ton ship into the heart of China, ascending the Yang-tse to Hankow, the great tea *entrepot*, 1,400 miles, by map measure, from Shanghae. He found a great city and flourishing trade, with about thirty British hongs, built upon land granted by the Chinese Government, more hongs building, and every sign of great commercial prosperity. A club-house and church are building, and, of course, the third sign of civilization—a gallows—cannot be long delayed. The anchorage opposite the town is fairly safe, the risk of voyage is not excessive, and there seems little doubt that Hankow will henceforward be in direct communication with London. This is really a great result from the capture of Pekin, the valley of the Yang-tse being as productive as that of the Ganges.

A Frenchman has discovered a substitute for paint over plaster. A coat of oxide of zinc, mixed with size, and made up like a wash, is first laid on the wall, ceiling, or wainscot, and over that a coating of zinc, prepared in the same way as the first wash is applied. The oxide and chloride immediately effect a sort of combination, forming a cement, smooth, and polished as glass, and possessing the advantage of oil paint without its disagreeable odour.

The Lords of the Admiralty have entered into a contract with Messrs. J. Brown and Co., of Sheffield for the supply by that firm of upwards of 1,000 tons, of armour-plating for the iron-cased frigate "Lord Warden," at Chatham. The armour plates with which the "Lord Warden" will be covered will be 5½ in. in thickness for her lower broadside tiers, and the remainder 4½ in. in thickness; the "Lord Warden" differing in this respect fron the other armour-plated frigates in having her armour-plates of the same thickness on the stem and stern as on her broadside. The blocks for the new frigate have been laid on number No. 7 slip for some time, and the frame cut out; but in consequence of all the available hands at Chatham having been employed for several months past in completing the "Achilles," the commencement of the "Lord Warden" has been unavoidably delayed.

The armour-plates tested at Portsmouth on the 13th inst., a report of which appeared in the *Times* of the following day, have been taken off the sides of the "Monarch" target-ship and landed at Portsmouth dockyard, in order that their reverse sides might be examined by the members of the Iron-plate Committee and further reported upon. Two of these plates, sent in by Messrs. Cammell and Co., of the Cyclops Works, Sheffield, have attracted much attention by their excellence of material and manufacture, coupled with the fact of their being the first essay of their makers in the production of armour-plates, and, it is stated, the only instance in which any firm have succeeded in passing the Admiralty standard with so high a figure of merit on a first trial. One of these plates was of 5½ in., and the other of 4½ in. thickness. An examination of the reverse side of both discloses very little damage; and what openings there are in the metal run in the direction of the fibre, both plates being remarkable for the absence of vertical cracks or openings, and of any connection between what openings exist and the boltholes. The welding of both plates was found to be perfect. The 5½ in. plate on the day of trial received shot in a space measuring 34 in. by 18 in. On examining the reverse of this space, the damage found to have been inflicted by the six shots was considerably less than had been expected, no part of the iron being separated from the main body, and the cracks on the surface of the metal being very slight. During the past week a few steel and cast-iron spherical shot have been fired at one of the Millwall plates, that was tested some short time since, from the Armstrong 100-pounder smooth-bore lately forwarded from Woolwich to Her Majesty's ship "Excellent." As, however, the firing was limited, the results were comparatively unimportant.

The Board of Trade returns for the month of October are the most remarkable ever published, since they show an increase, wholly unprecedented, of 53 per cent. in the declared value of our exportations, compared with the total in the corresponding month of last year—the amount being £15,082,332 against £9,846,835, an excess of £5,235,497. Compared with October 1861, the increase is £3,397,422, or 29 per cent. The total of our shipments of cotton goods, exclusive of yarns, was £4,227,255, showing an increase of 140 per cent. in value, while the increase in quantity was 111 per cent. Of cotton yarn the total exports were £939,346, against only £266,693 last year. In haberdashery the increase has been 45 per cent.; in hardwares, 28 per cent.; in woollens, more than 40 per cent.; in linen, manufactures, 43 per cent.; and in machinery, 84 per cent. The exports of silk manufactures show a slight falling off. Of metals the quantities have been large in every instance, with the exception of lead. These extraordinary figures fully explain the then hidden causes of the constant absorption of gold for the purposes of internal circulation which was found to be taking place about eight or nine weeks back, and demonstrate the correctness of the supposition then expressed that some influences of an unusual character were in operation.

The new Admiralty night signals, introduced about two years ago by Mr. W. H. Ward, were tested on Tuesday night at the flagstaff in Woolwich dockyard, in the presence of the Commodore-Superintendent, Sir F. Nicolson, C.B., and other officers, in pursuance of instructions transmitted by Lord C. Paget, Secretary to the Royal Navy. The signals since their introduction have been in general use throughout the Mediterranean and Channel squadron. Mr. Ward has now suggested a slight improvement in the hoisting apparatus, in order to accelerate the issuing of signals and the facility of replying. The improvement consists of one hoist to each signal, which appears to save considerable time in the operation. A number of messages were transmitted through the fog, and the signals were witnessed on the river by Sir F. Nicolson, who went down in his gig for that purpose, his position being made known by one of the signal lamps placed in the gig, and with which the signals were answered. One person took charge of the signal station and assisted the inventor in operating, which was done with the same facility as with the flags by day. By the improved arrangement the work lines are dispensed with, and the system is pronounced materially benefited and simplified. The lamps used were the small models employed by the Channel fleet in August, 1860.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Boilers and Furnaces—*none*.
Buildings and Building Materials, 1073, 1096.
Chemistry and Photography, 1021, 1036.
Cultivation of the Soil, including agricultural implements and machines, 1022, 1033, 1042, 1058.
Electrical Apparatus, 1069.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1038 1037, 1056, 1057, 1061, 1064, 1070, 1074, 1075, 1079, 1085.
Food and Beverages, including apparatus for preparing food for men and animals, 1040, 1083.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1026, 1027, 1046, 1047, 1048 1050, 1068, 1077.
General Machinery, 1029, 1032, 1045, 1060.
Lighting, Heating, and Ventilating, 1031, 1041, 1065.
Metals, including apparatus for their manufacture, 1024, 1025, 1053, 1059, 1063.
Miscellaneous, 1020, 1030, 1044, 1049, 1066, 1067, 1071, 1072, 1078, 1082, 1084.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1035.
Ships and Boats, including their fittings 1034, 1055, 1080.
Steam Engines, &c., 1038, 1052.
Warfare, 1023, 1043, 1051, 1062, 1081.

1019. J. Knowles and S. Jackson. *Certain Improvements in apparatus for heating water in furnaces, flues, and chimneys.* Dated April 24, 1863.

Provisional protection has not been allowed for this invention.

1020. R. Lavender. *A new compound to be used as a lubricator.* Dated April 24, 1863.

In carrying out this invention, the patentee takes ten parts of the hydrocarbonaceous material known as paraffin oil, of any density best suited for the especial compound; he then adds to it one and a half parts of common gum resin, or any of the resinous gums that are soluble in the above material. These two are mixed together by heat or otherwise, and after being properly united, he takes lime water up to the point of saturation (or any of the alkalies which will cause saponification) and adds it to the above compound, stirring or agitating it in such a manner as to bring it into contact with the alkaline properties, thereby saponifying the mixture to any degree he may deem necessary. These materials, when chemically united, form an unctuous compound, that is well suited for all purposes of lubrication. *Patent completed.*

1021. P. Passavant. *Improvements in the manufacture of blue colouring matter, and also of violet colouring matter.* (A communication.) Dated April 24, 1863.

In manufacturing this blue colouring matter the inventor takes four parts of fuchsine, eight parts of aniline oil, and two parts of acetate of soda, and heats this mixture slowly to 160 deg. Reaumur, at which temperature he keeps it for two hours, when he raises the same to 200 deg. Reaumur, again maintaining that heat for two hours. As soon as the required shade is obtained, the mixture is taken from the fire, and poured into four parts of alcohol, to which are added twelve parts of muriatic acid, for the purpose of neutralizing the blue matter. When cooled, he obtains a hard brownish black substance, which is ground, and then boiled for a quarter of an hour in a quantity of water, with eight parts of sulphuric acid. This mixture is filtered, and the blue matter obtained is boiled twice in eight parts of muriatic acid, for the purpose of destroying the red tint which has remained more or less in the blue matter. After this operation, he washes the blue matter several times in warm water, until all vestige of acid has disappeared. When this mixture has been pulverized and dried, he pours on the powder ten parts of alcohol, and lets it stand a few hours, until all vestige of red colour has disappeared. He then filters the mixture, pulverizes and dries it, and the powder thus obtained is fit for dyeing purposes. He calls it Bleu de Nuit. *Patent abandoned.*

1022. J. Cornes and J. G. Davis. *Improvements in lawn-mowing, rolling, and collecting machines.* Dated April 24, 1863.

This invention consists in so constructing machines employed for the above purposes as to impart to them an undulating motion, by adapting springs to the axes of the revolving parts of the said machines; and, further, in combining revolving brushes therewith, one of the said brushes being fixed upon the axis of the small running wheels, situated at opposite sides of the framing of the machine, and resting upon the surface of the ground immediately in front of the revolving cutters, which are of the ordinary spiral form. This brush is intended to raise the blades of grass if laid, and present them to the cutters. The other brush above referred to is intended to lift the cut grass from the cutters, and assist in depositing the same in a box or receptacle fixed above the cutters, and in front thereof. Another feature in this invention consists in connecting the axis of the small running wheels and cutters before mentioned to two bent levers, mounted loosely upon another axle, the ends whereof revolve in bearings in the sides of the framing of the machine. Upon the middle of this axle a spur pinion is fixed, and gears into a spur wheel mounted loosely upon another axle, carrying the driving roller of the machine, which runs on the surface of the lawn in the ordinary manner. A further improvement in lawn-mowing machines consists in adapting helical springs around the axle of the aforesaid driving roller, which press against the clutch boxes, and thus keep them always locked with the driving spur wheel, thus dispensing with the necessity for keeping the clutch boxes pressed in gear by hand during the working of the machine. The patentees propose to throw the cluches out of gear by levers, and hold them so by pins when the cutters are not required to be in action. In connection with the bent levers before mentioned, and to the upper arms thereof, a rod is loosely connected by its ends, and at the centre of the said rod a screw nut is formed, which carries the screwed end of another rod extending horizontally at right angles to the former rod; this second rod is supported in a bearing at the hind part of the machine, and has a lever wheel fixed thereon for turning the screw round, by doing which the bent levers aforesaid, together with th

parts connected thereto, may be readily raised and lowered, and the cutters adjusted any desired distance from the surface of the ground. By these means, and by adjusting nuts placed upon the supports of the axis of the cutters and running wheels before mentioned, the said cutters may be set to a nicety, so as either to cut only the tops of the blades of grass, or cut it close, as may be desired. The cutters are driven by spur-gearing. There is a castor roller and handle connected to the front part of the framing of the machine, and there are also handles at the back of the machine. *Patent completed.*

1023. J. THOMPSON. *Improvements in the manufacture of barrels for firearms and other description of tubes, and in apparatus or machinery to be employed for that purpose.* Dated April 24, 1863.

This invention consists in making barrels for firearms without weld or joint, and with a solid breech; and also in making other descriptions of tubes which may require to have solid parts upon them. The patentee effects by means of rolls of peculiar construction, and by employing a thick solid tube or billet of metal, with a hole punched through it for the formation of such tubes. This billet or thick tube is first passed in a heated state (if the metal is of a kind to require heat) through preparing rolls of the ordinary construction, by which it is lengthened or drawn out, and it is then removed to rolls formed with a double collar in one or both sides of the groove, or with a collar and a bearing; a stop-piece is fitted into the groove, against which stop the roller places the end of the barrel or tube; this stop also acts as a guide to indicate when the barrel is to be put in the roller, and governs by its position in the rolls the length of the barrel or tube. At any suitable point in the periphery of the grooves of one of the rolls, a sinking is formed to shape the breech or solid part of the barrel or tube, and as the barrel requires turning in the direction of its circumference after every rolling an opening is cut through the bearing of the roll to admit the breech or solid part, which is thus forced against the roller and against the stop, and shaped. *Patent completed.*

1024. J. THOMPSON. *Improvements in machinery for punching metals.* Dated April 24, 1863.

This invention consists of improvements upon, or additions to, the steam hammer, for the purpose of adapting it to punching masses of steel, steel iron, iron, or other metals, to be subsequently manufactured into ordnance barrels for firearms, and various other description of tubes, and for other like uses. The patentee fits in the head of a steam hammer a suitable punch, and in the anvil a suitable die, having an aperture through the bottom to allow the plug struck out by the punch to pass through. A guide apparatus, consisting of slides upon the anvil, keeps the blank in position whilst it is struck by the punch. This guide apparatus is governed by four wheels, so that an attendant may release the blank after it is punched, by means of a lever below the anvil block, and throw it out of the die. The blank thus prepared is ready for rolling, drawing, or swaging into a tube which will have no joint. *Patent completed.*

1025. W. A. SHAW. *A mode of lining lead pipe with tin or its alloys.* Dated April 24, 1863.

This invention consists in the manufacture of lead pipe with a lining of tin, by forcing an ingot of tin and an ingot of lead while over a core out of a cylinder through a die by hydraulic pressure. *Patent completed.*

1026. J. HINKS and J. NEWMAN. *Improvements in the manufacture of buttons.* Dated April 24, 1863.

One portion of this invention consists in making buttons commonly called four-holed buttons, or brace buttons, and other buttons, in the following manner:—The inventors cut the blanks from which they make the said buttons from tin plate which has been planished by rolls, or by the process called wheeling, and afterwards polished and burnished, and they make up the buttons from the said blanks in the usual way. *Patent abandoned.*

1027. J. H. JOHNSON. *A filtering apparatus for treating by pressure oils, syrups, and all sorts of liquids susceptible of filtering.* Dated April 24, 1863.

This invention consists in the employment of a peculiar arrangement of apparatus for filtering liquids, whereby such operation may be effected under pressure. The liquid to be filtered is contained in a vessel or tank, to which a suction and force pump is connected, which pump is also in communication (by means of a pipe) with a strong filtering vessel. The filtering vessel is provided with a manhole at the top, and a grating at the bottom, upon which grating is placed the filtering medium, consisting of felt or other suitable material. Immediately beneath the grating, and secured to the filtering vessel or otherwise, there is fitted a hemispherical or other receiver, in which the filtered liquid is collected and drawn off by a central pipe and stop cock. The liquid to be filtered is pumped into the filtering vessel, and the pumping is continued after such vessel is full, in order that the liquid therein may be in a state of compression, which state facilitates and expedites the process of filtering by forcing the liquid through the filtering medium. In some cases this apparatus may be employed as a press—as, for example, by introducing olives into the filtering vessel, and injecting and forcing therein under considerable pressure hot water, the oil will be expressed, and thus the double effect of the press and the filter or purifier is obtained. *Patent completed.*

1028. C. POOLEY. *Improvements in certain parts of machinery for preparing and spinning cotton and other fibrous substances.* Dated April 25, 1863.

This invention is applicable to all machines in which drawing and calender rollers with top rollers are employed, and it consists in an improved mode of constructing the weight hooks and saddles to which the ordinary weights are suspended. It has heretofore been customary to make a hole in the weight hooks and saddles through which the oil is poured for lubricating the top roller. Now, this invention consists in making the weight hooks and saddles with recesses or chambers containing a wad of felt, or other suitable material, saturated with oil or other lubricating compound, which, as the top roller revolves, passes through small holes at the bottom of the recesses or chambers, and thus lubricates the top rollers. Another part of the invention consists in suspending the weight hook to a projection within the saddle, which is made broader than usual to reduce friction. *Patent completed.*

1029. L. DE BREANSKI. *Improved apparatus for fixing drills, which invention is also applicable for fixing apparatus for raising, supporting, and suspending weights, and for other analogous purposes.* Dated April 25, 1863.

The chief object of this invention is to provide a means for applying drills to the drilling holes in metal plates or beams when fixed in a position more or less vertical or perpendicular—for example, in framing and plates of iron ships, boilers, bridges, and other structures. In effecting this object, the patentee provides the drill with a ratchet lever, crank, or winch handle, and mounts it in an adjustable holder, using as a purchase or support of the drill holder, at any desired part of the plate or other surface to be drilled, a modification of what are known as "pneumatic bells," consisting of a metallic bell or cup closed by a disc or plate of vulcanized india rubber, or other suitable elastic material, which acts as an exhausting piston, and forms a partial vacuum between the bell and the surface to which it is applied, so that the requisite amount of adhesion is obtained by atmospheric pressure to resist the pressure of the drill and support the parts in position that carry the drill. *Patent completed.*

1030. S. HARRISON. *A new and improved mode of manufacturing type for letterpress printing.* Dated April 25, 1863.

At present the usual mode of manufacturing type is by casting one letter or type at once. This invention consists in casting a number of types, say, from 10 to 100 at once, and then cutting, breaking, or sawing them into separate letters or types. *Patent completed.*

1031. A. H. CLARK. *Improvements in valves for water, steam, and gas.* Dated April 25, 1863.

According to this invention, the inventors make the seat of the valve in a plane in which the axis of the pipe is situated, the ingress and egress pipes being placed on either side of, and opening respectively above and below, the said seat. The valve rises and falls in a line at right angles to the axis of the pipe. The said valve is fitted to a stem or axis, the upper part of which is made into a screw. The lower cylindrical part of the said stem or axis passes through a stuffing box, which is fixed upon and closes the opening in the pipe at which the valve is introduced. The upper screwed portion of the stem or axis works in a concave screw in the plate closing the top of the stuffing box. By means of a winch or handle on the top of the valve stem or axis, the said stem or axis can be turned and the valve raised or lowered. The height to which the screw is raised out of the stuffing box indicates the height to which the valve is raised from its seat. The gland by which the packing is compressed around the cylindrical part of the valve stem is held down by screws engaging in the top of the stuffing box. *Patent abandoned.*

1032. T. A. WESTON and C. VIVIAN. *Improvements in pulleys, capstans, and other machines for raising weights and transmitting motive power.* Dated April 25, 1863.

This invention comprises certain means for holding the rope, chain, or band firmly on the pulley, capstan, or other machine during the time the said rope, chain, or band is passing over the pulley, or other machine, and communicating motion thereto, or receiving motion therefrom. *Patent abandoned.*

1033. J. P. and E. B. NUNN. *Improvements in hoes and cultivators.* Dated April 25, 1863.

This invention consists in the employment of a circular disc or polygon, with the cutting edge or edges placed horizontally, or at a slight angle to the horizon, and fitted on the lower end of an upright shaft, free to revolve, and also to rise and fall within certain limits in a tube or tubular bearing fixed in or connected to a beam. Upon the implement being drawn or propelled through the soil, the cutting disc will be caused to revolve, when the pressure on one side is greater than that on the opposite side, thus preventing any accumulation on the cutting edge or edges. *Patent completed.*

1034. J. DUNBAR and J. W. WOODFORD. *Improvements in apparatus for steering and manœuvring ships and vessels.* Dated April 25, 1863.

For the purposes of this invention, an upright shaft or axis is applied at or about the centre or midships of a ship or vessel, the lower end of which passes through the bottom, and has affixed to it radial blades or vanes which come just below the bottom of the ship or vessel, or within a recess formed in the bottom. The upright shaft or axis passes within a tubular passage fixed within the ship, which rises to a height sufficiently above the water line; or a suitable stuffing box or other provision is to be made in order that no water may get into the ship or vessel, and when desired the shaft or axis may be raised in order that the vanes or blades may be replaced. The shaft or axis is acted on by steam or other power to give rotary motion thereto, in order that the axis or shaft, and the blades or vanes fixed thereto, may be caused to rotate towards the right hand or to the left, according to the direction in which it is desired that the vessels should be steered. *Patent completed.*

1035. L. A. J. BRUET. *Improvements in apparatus for registering, indicating, and verifying the time and distance passed over by vehicles, also applicable to machinery and other similar purposes.* Dated April 25, 1863.

This invention consists—1, in a method of indicating whether the vehicle is disengaged or employed; 2, in showing the distance travelled over, and the time the vehicle has stopped, calculated or represented in distance; 3, in a mode of marking, indicating, and verifying or proving the work performed by the vehicle or machine. A suitable external sign is placed on the front and top of the case of the mechanism, or on the driver's box, for indicating that the vehicle is disengaged or not hired. But when a fare is taken, the driver turns a handle a quarter of a circle, causing thereby the external sign to be lowered, and to disappear, and at the same time to actuate the gearing required for the motion of the apparatus or mechanism of the distance index. The handle in turning performs three separate operations. The first shows that the vehicle is not hired; the second, or first turn of a quarter of a circle, shows that the vehicle is hired by the mile—that is to say, the distance run over, to which may be added the time of the stoppages, represented by the proportional mean of the distance (calculated at about 5 miles per hour); the third operation indicates the slow motion of the vehicle—that is to say, that independently of the velocity of the vehicle, the mile or distance index will constantly indicate a mean velocity of the vehicle when in motion, and its stoppages. By these means only one tariff per mile for all cases is required. When the fare leaves the vehicle, the handle is returned to its rest mark, the mileage index hand returns to 0, and the internal sign reappears. All these operations shown to the fare or traveller are written or marked on an internal plate or dial; also the time of each of these operations. *Patent completed.*

1036. A. POIRRIER and C. CHAPPAT. *Improvements in the manufacture of blue and violet colouring matters, suitable for dyeing and printing.* Dated April 25, 1863.

For the purposes of this invention the patentees take the aniline reds (known in commerce under the names of fuchsine, roseine, magenta, and under other names, and chemically as being different salts of rosaniline), and they treat these red colours with napthylamine—a substance which is derived from napthaline, as aniline is derived from benzine. *Patent completed.*

1037. F. WALTON. *Improvements in the manufacture of fabrics for covering floors and other surfaces, and in the apparatus employed therein.* Dated April 25, 1863.

For the purposes of this invention, canvas, or other suitably strong fabric, is coated on its upper surface with a composition consisting of oxidized oil (prepared, by preference, in the manner described in the specification of a patent, granted to the present inventor the 27th January, 1860, No. 209), cork dust, and gum or rosin, preferring gum kaurie, or New Zealand gum; such surface being afterwards printed, painted, embossed, or otherwise ornamented. The back or under surfaces of such fabrics are coated with a coating of such oxidized oils, or oxidized oils and gum or rosin, and, by preference, without any admixture of cork. *Patent abandoned.*

1038. O. BEYER. *Improvements in safety valves.* (A communication.) Dated April 25, 1863.

It is well known that the common or ordinary safety valve, when loaded to counterbalance a given pressure of steam, does not lift or blow off freely until the pressure has increased to a considerable extent above the pressure fixed upon; consequently, the boiler is but slowly relieved of the excess of pressure owing to the small area of the opening of the valve. The object of this invention is wholly or partially to remove this defect, by causing the safety valve, when the pressure has become sufficient to overcome the weight upon it, to lift much higher than the ordinary safety valve, and thus give a larger opening for the escape of the steam or other fluid; and the invention consists in forming a flange round the valve, commencing at the inner edge of the valve facing, which is undercut and concave in shape, and the concave side is towards the seating of the valve, which has also a flange upon it, commencing at the outer edge of the valve seating; but the upper surface of the flange is convex, and corresponds nearly to the concave surface of the flange upon the valve. There is a slight space between the concave and convex surfaces of the two flanges, which diminishes towards the outer edge of the flanges. When the steam begins to escape from between the surfaces of the valve, it gets between the concave and convex surfaces of the two flanges, and its force thus acts upon a larger area, and reacts upon the concave surface of the valve, and causes it to open to a greater extent than the ordinary safety valve. *Patent completed.*

1039. I. DIMOCK. *Improvements in machinery for cleaning, sorting according to size, and doubling silk and other threads.* Dated April 25, 1863.

The patentee claims—1, the system or mode described of cleaning and sizing threads at the same time; also, the system or mode described of cleaning, sizing, and doubling at the same time. 2, the use of wedge-shaped spaces for sizing threads, and arrangements for varying the position of the thread or threads to be sized in such spaces, as described. 3, the use of a piston or its equivalent in connection with oscillating, gauging, or sizing mechanism, to moderate or prevent irregularities, as described. 4, the use of stopping arrangements in connection with mechanism for sizing threads, acting in the manner described. 5, the system or mode of doubling two threads, as described. 6, the method and arrangements for unwinding sized thread, as described. *Patent completed.*

1040. A. LEGRAS. *Improvements in machinery or apparatus for making ices.* Dated April 25, 1863.

According to this invention, one or more freezing apparatus are actuated by means of driving bands or gearing from one driving shaft common to all, provided with suitable clutches, whereby the working of any one or more of the apparatus may be arrested without interfering with the working of the rest. Each freezing apparatus consists of an outer fixed tube or vessel, in which rotates a metal cylinder, supported upon a footstep bearing in the bottom of the outer vessel. A vertical spindle passes up the centre of the metal cylinder, and is supported at the upper end by a suitable bracket piece, fitted into a socket in the edge of the tube. The cylinder is closed at the bottom and open at the top, its mouth being level with the top of the outer tube or vessel. Round the mouth of the cylinder there is soldered a metal collar, round which the strap or driving band passes, slots or openings being made in the side of the outer vessel for the strap or band to work through. The freezing mixture is introduced into the outer vessel or tube, and the

cream or other ingredients to be manufactured into ice are contained in the metal cylinder, or inner rotary vessel, an annular lid or cover being placed over the tube, so as to cover the mouth of the same, and leave the mouth of the cylinder open. *Patent completed.*

1041. J. T. STROUD. *Improvements in the manufacture of, and in the machinery and appliances for, holding, drilling, turning, tapping, fitting and shaping certain parts of steam, water, gas, and lamp fittings.* Dated April 25, 1863.

Provisional protection has not been granted for this invention.

1042. W. E. NEWTON. *Improvements in thrashing machines, parts of which improvements are also applicable for hulling, decorticating, cleaning, and polishing grain and seeds.* (A communication.) Dated April 25, 1863.

The patentee claims—1, the thrashing, decorticating, and cleaning of grain or seeds by passing them between two cylinders, in the manner and for the purpose set forth; 2, grooving or fluting one of the cylinders, the other being covered with an elastic substance, such as caoutchouc; 3, driving the cylinders at different speeds; 4, the general arrangement of apparatus. *Patent completed.*

1043. A. V. NEWTON. *Improvements in breech-loading firearms.* (A communication.) Dated April 25, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1044. M. BARLAND. *An improved apparatus for milking cows.* (A communication.) Dated April 25, 1863.

Provisional protection has not been granted for this invention.

1045. S. OSBORNE. *An improved machine for unwinding crinoline steel.* Dated April 27, 1863.

This invention consists in placing a piece of wood, or any other suitable material, above and parallel with the roller, the ends of which parallel piece are to slide in grooves in the uprights which support the roller, and to be acted on by a spring or springs, so placed as to press the parallel piece towards the roller. The invention also further consists in a piece of brass or any other suitable material passing down each side of the roller, and through the parallel piece above the roller, and made moveable by a screw to suit any steel which may be put on the roller; the steel on the roller is kept on the one side by the upright, on the other by the brass, and above by the parallel piece; and thus prevented from springing about in any way, and by means of a handle placed to the roller, the crinoline steel can be rolled off or on at pleasure. *Patent abandoned.*

1046. G. SPILL, T. J. BRIGGS, and D. SPILL. *Improvements in the manufacture of mill straps and driving bands.* Dated April 27, 1863.

This invention consists in imbuing wool, woolly substances, cotton, linen, jute, flax, or any fibrous substance (either in the form of prepared fabrics, or in the form of warps, wefts, or any other form whatever) with glue, gelatine, or any gelatinous substance, either animal or vegetable, and from whatever source derived. These matters are to be combined with the above-named materials either in the wefts, warps, or webs, or in the actual process of fabrication. The precipitating of the gelatine into the body of the said materials or substances is effected by any astringent substance, such as sulphate of alumina, catechu, bark, gallic acid, or gallate of iron, and the impregnation of the same by any metallic base or bases. The inventors also imbue the aforesaid fibrous substances with india rubber, or any compound thereof. *Patent abandoned.*

1047. H. E. CARCHON and E. F. RAYBAUD. *Improvements in the manufacture of hats and bonnets, and mode of preparing feathers to be used in the said manufacture.* Dated April 27, 1863.

This invention consists in substituting the outer covering or surface of the backs of the stems of feathers for the straw and other materials at present employed in the manufacture of bonnets, hats, crinolines, and other similar articles, where lightness, elasticity, and durability are required. The mode of preparation is extremely simple. The back of the feather being the most suitable part, it is carefully stripped off and cut the length and thickness required; thus prepared, it is plaited and made up in the same way as straw, to which, from its elasticity, it is infinitely superior. *Patent completed.*

1048. J. J. ROBERT. *Improvements in the manufacture of spoons and forks.* Dated April 27, 1863.

This invention consists in covering with an extra coating of silver those parts of forks and spoons most exposed to wear. *Patent completed.*

1049. W. E. GEDGE. *Improvements in tuyeres or blast pipes and in apparatus connected therewith.* (A communication.) Dated April 27, 1863.

The tuyere or blast pipe, made according to this invention, is provided with a regulator for the escape of the wind, and a balance compass for opening the outlet pipes without disturbing the symmetry of the fire. This compass or double lever may be applied vertically in the side of the furnace, or horizontally on its face. The moderator or regulator with which it is provided consists of a moveable washer, which, on the handle of the moderator being pulled, partially or entirely closes the pipe at will. A revolving door for delivery of coal, and a lubricating or grease pipe also forms part of this apparatus. In the thickness of the tuyere cap (which is then of semi-spherical shape) may be made an excavation, into which water will be brought by a pipe connected with the lower ring of the tuyere. *Patent abandoned.*

1050. M. VALKENHUYZEN. *A new castor for furniture.* Dated April 27, 1863.

The patentee claims—1, the use of a double plate to constitute the system of rotation; 2, the use of a double circular groove corresponding between the two plates, to serve as channel for the rotating balls or beads; 3, the use of loose balls or beads of hard material rolling in the circular groove between the two plates; 4, fixed rivetting of a rod or stem more or less long in the upper plate, and loose rivetting of the same in the lower plate, to facilitate the movement of the cheeks or cap in every direction; 5, the nearly vertical cheeks or cap forming one piece with the lower plate. *Patent completed.*

1051. W. RICHARDS. *Improvements in ordnance firearms and cartridges.* Dated April 27, 1863.

In constructing ordnance according to this invention, the inventor employs an inner tube or liner, and he shrinks or forces on to this exterior rings or tubes, as has heretofore been practised. The inner tube or liner he makes of steel or iron, faced interiorly with steel, in order that it may be less liable to wear, or be injured in fixing, than if it were of iron; and, further, for the purpose of ensuring that the inner tube or liner shall be efficiently supported by the exterior ring or tubes, he splits the tube or liner from end to end, before the exterior rings or tubes have been shrunk or forced upon it, and he prefers that this split should follow one of the grooves in the rifling of the piece, and that it should be inclined at a considerable angle to a radius of the bore. By this arrangement the inner tube or liner will be rendered capable of expanding slightly, and nearly the whole strain of the explosion will fall on the exterior rings or tubes, even should these not be perfectly fitted. In constructing the barrels of fowling-pieces and similar firearms, he employs a thin steel tube, and he cases the breech end thereof with iron, in order to give to it the strength required to resist the strain of firing; but the end of the tube which forms the muzzle of the barrel he leaves uncased, as it will not be exposed in firing to a sufficiently severe strain to render this necessary. He cases the breech end of the steel tube by lapping a band of iron around it, and adding it to the tube. In this manner he obtains a light and safe barrel, with an interior surface of steel, which is not so liable to rust, and is less subject to wear than an ordinary wrought-iron barrel. In making cartridges for breech-loading fowling-pieces, he places at the back of the case of the cartridge a wad, which is saturated with wax, or other material. The wad has a small hole formed in it, and a tube or long capsule is passed through it; the tube or capsule is conveniently made of thin copper, and is charged with fulminating material. At the back of the cartridge, and behind the wad, a pin passes through the side of the cartridge, and its lower end rests on the exterior of the tube or capsule containing the fulminating material. When the capsule is placed in the gun, and the gun is fired, the hammer strikes the pin, explodes the fulminating material, and ignites the powder at the front end of the tube or capsule. *Patent abandoned.*

1052. J. JEFFREYS. *Improvements in constructing surface condensers, and apparatus for heating and cooling fluids.* Dated April 27, 1863.

This invention consists, mainly, in constructing surface condensers of steam engines with thin plates of copper, or other metal, which the inventor presses or stamps with numerous parallel flutes; separated the one from the other by flat ridges. These plates are then placed together in pairs, face to face, so that the ridges of one plate come truly over those of the other, but they are separated by a soldering or brazing metal placed between the two. The pairs of fluted plates thus arranged are piled up one pile over the other, but with suitably-fluted plates of iron between the pairs, so as to make a solid pile, which is then placed under pressure to bring the ridges of the two plates of each pair close up the one to the other; in this state the pile is heated till the soldering or brazing melts, when the plate still under pressure, or placed if necessary under increased pressure in a press, is allowed to cool. *Patent abandoned.*

1053. F. BENNETT. *An improved method of condensing lead and other metallic fumes and vapours from furnaces.* Dated April 27, 1863.

This invention has for its object the condensation of the metallic fumes of lead, copper, and other ores and minerals, also noxious smoke and gases, salts, acids, and other vapours volatilized from smelting and other furnaces. The patentee places a wheel, by preference constructed on the principle of the archimedian screw, or any other form of wheel, with vanes or floats in the main flue, or in a separate chamber arranged for the purpose, through which all the waste or volatilized metallic fumes, smoke, gases, salts, acids, and vapours to be condensed are passed; and he causes a constant supply of water to be maintained at such a level in the chamber or flue that the ends or more of the vanes may be immersed. He imparts rapid rotary motion to the wheel, when the metallic fumes and other products are drawn and thrown to the periphery; the vanes at the same time throw a constant spray or quantity of water, which, mingling with the fumes and other products, condenses them. Should perfect condensation not be effected by one wheel, a second wheel or more may be employed in the same flue or chamber, or in similar flues or chambers, and the process repeated over and over again until entire condensation is secured. *Patent completed.*

1054. R. A. BROOMAN. *Improvements in twisting and doubling silk, and in frames employed therein.* (A communication.) Dated April 27, 1863.

To overcome the many disadvantages arising from the use of separate frames or machines, the inventor has devised a method of effecting the most simple preparation of silk upon one frame, and at one operation, and the most complicated preparations upon one frame at one time, the winding not being included—that is to say, that the first torsion, the second torsion, and the doubling are simultaneously effected by one single operation. A frame fitted according to this invention, unites and combines in one single operation three operations which heretofore necessitated as many frames. With the exception of the winding, he performs upon the same frame, and at the same time, the first and the second torsion, as well as the doubling, when the two torsions are necessary. *Patent abandoned.*

1055. W. H. JAMES. *Improvements in indicating the locality of fire, applicable also to denoting the position of ships.* Dated April 27, 1863.

This invention consists in the combined employment of a spy-glass or telescope from a fixed tower, and of a map of the city, town, or locality within the range of a telescope from the point of observation, and in causing a tracer to travel with the motions of the telescope, and indicate on a map the spot at which the object observed is situated. The inventor takes his observation from a high tower, and places the observing glass in a frame free to move horizontally and vertically; he connects this frame by rods with a tracer which partakes of similar motions to those of the frame; and, according to the angle and the position of the glass, so the tracer indicates the spot on the map of the object observed. *Patent completed.*

1056. W. HUDSON. *Improvements in looms for weaving.* Dated April 27, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1057. A. ROLLASON. *Improvements in dyeing and staining fabrics, parts of which improvements are also applicable for dyeing, staining, and ornamenting glass and other substances.* Dated April 27, 1863.

This invention relates, in the first place, to a mode of dyeing or staining woven fabrics or paper that have been rendered waterproof by being coated with solutions of pyroxyline, either alone or mixed with oils, gums, rosins, or other suitable substances, which are capable of combining or being mixed with volatile, ethereal, or spirituous liquids. The fabrics having been coated in the ordinary or any convenient manner with the waterproofing liquid, may be dyed or stained of various shades of colour, by simply applying a methylic, alcoholic, or ethereal solution of the desired colour to the surface to be operated upon. Aniline colours, or colours obtained from coal tar, are the colours the inventor usually employs. *Patent abandoned.*

1058. H. BEARE. *Improvements in machinery for thrashing out corn from its straw, part of which is applicable for combing the straw.* Dated Aprill 27, 1863.

According to these improvements, the patentee uses a cylinder, on which he places the teeth or radial pins, and distributes them uniformly throughout its entire length and periphery. They may be set in spiral or helical lines, or otherwise, but in either case should have very few teeth engaging in the corn at one time. This apparatus is also used for thrashing out the corn and combing the straw for thatch and other purposes. In thrashing machines in which the straw is allowed to pass through and the winnowing conducted at the same time, he applies a feeding apparatus consisting of radial teeth on a drum, reel, or cylinder, such as before described, which takes up the corn to be thrashed and feeds or supplies it to the machine, which it does in a regulated and efficient manner, although the sheaves or parcels of corn may be thrown in by the attendant indiscriminately. To facilitate the feed, he mounts over this rotating toothed feeder a concave surface; this leads the corn into the concave and beater below, into which it passes, and is acted on in the ordinary way. The feeder may be used at the same time as a comber. The feeder has rapid rotary motion communicated to it by a strap from the driving-gear of the machine, which is driven by horse or steam power, as usual. *Patent completed.*

1059. S. INGLEDEW. *Certain improvements in obtaining iron from its ore, and in the subsequent treatment thereof, for converting the product into a metallic state, and in apparatus connected therewith.* Dated April 28, 1863.

This invention consists, first, in reducing the ore by grinding or pulverizing in an ordinary grinding apparatus, or one suitably arranged for the purpose; it is then to be placed in a perforated rotating chamber or receptacle, through which water passes, wherein the heavier particles of granulated metal are precipitated by gravity to the bottom, the lighter earthy and other matters being carried off by the water. This residuum of wasted granulated iron ore (which still retains a small quantity of silica and silicate of potassium), is then conveyed to an open flat vessel or drying frame, where the moisture is evaporated therefrom, and it is afterwards passed into an ordinary air or reverberating furnace, by which it is reduced to cast metal. *Patent abandoned.*

1060. J. and W. MARRIS. *An improved machine for breaking loaf sugar.* Dated April 28, 1863.

This invention consists of two metal frames, about 4 ft. high and about 2 ft. wide, and two circular saws, one 24 in. in diameter, and the other 13 in. in diameter, fixed one inside and the other outside these frames, and working on a spindle, and two pair of metal rollers with steel knives fixed underneath the spindle. The advantages of its use are, among others, a great increase of amount of sugar cut by the same power. The sugar retains its clean white appearance, because it is not handled as when hand cut, and the crystal hue fracture of the cubical lumps is preserved in brilliancy, because the sugar is broken or chopped and not sawed. *Patent completed.*

1061. S. CRABTREE. *Improvements in balling [illegible].* Dated April 28, 1863.

This invention consists in forming balls of slivers of wool, or other fibrous materials or wa[illegible] in such a manner that, when in course of the succ[illegible]ons these balls are placed to be worked up[illegible] following each other in the processes [illegible]her fibrous materials or warps, the s[illegible]n out from the inside of the said bal[illegible] the said sliver or warp has had hith[illegible]hus a considerable advantage gain[illegible]ers of wool or other fibrous mate[illegible]atentee effects this by drawing off the [illegible]nside of the [illegible] through the cir[illegible] of [illegible] the ends, as hit[illegible] middle of the [illegible] usually forme[illegible] barrel, tube, [illegible] sliver or war[illegible] fastened a[illegible] groove in [illegible] or spindl[illegible] usual [illegible] through [illegible] or war[illegible] upo[illegible]

inside through the circumference, by which means the sliver is made to come out from the ball perfectly straight and open. *Patent completed.*

1062. G. HALL and J. WELLS. *A new explosive compound applicable for all the purposes for which gunpowder is, or may be, used.* Dated April 28, 1863.

This invention consists in producing an explosive compound, for general purposes, of the following ingredients, slightly modified according to requirements—say, in the proportions of 100 :—The patentees take 47 parts of chlorate of potassa, 38 parts of ferrocyanide of potassium, together with about 5 parts of sulphur, or other chemical, such as refined sugar, which they have found to be preferable from two causes—1, it is less detonating or liable to explode from mere friction; and, 2, more perfectly explosive, leaving no deposit or fouling. They reduce these ingredients separately to a powder by grinding in a suitable mill, or otherwise, and when the ingredients are properly ground, they are to be thoroughly mixed, adding water or nitric acid diluted with water, which increases the strength, imparting to the compound a bluish green colour, and is readily taken up and incorporated with the other ingredients to permit the whole to be formed into a stiff paste; afterwards, they allow the composition thus prepared to stand, allowing the water used to evaporate, and then they add 10 parts of caoutchouc slightly incorporated with bisulphide of carbon, which has the effect of destroying any impurity in the general compound, so that there shall be less residue after the explosion. These ingredients must be thoroughly mixed one with the other, and if to be used in the form of powder, must be pressed and then granulated fine or coarse, as preferred, or according to the purpose for which it may be required to be used. *Patent completed.*

1063. A. KINDER. *Improvements in the manufacture of sheet metal, and in ingots or plates of metal, and in the machinery or apparatus employed therein.* Dated April 28, 1863.

This invention relates, partly, to a peculiar combination and arrangement of rolls and apparatus connected therewith, to be employed in rolling sheet lead or other soft metal, whereby the adhesion of the sheet metal to the rolling surfaces is prevented, and a better and more even sheet is obtained. *Patent completed.*

1064. W. CLARK. *Improvements in machinery for the manufacture of paper and of the various kinds of boards produced from fibrous substances.* (A communication.) Dated April 28, 1863.

This invention consists, principally, in the combination and arrangement of two or more cylinder moulds in such manner as to deliver their webs of pulp one upon anothtr, for the purpose of being pressed together to form a board of a required thickness, and in the arrangement of drying and calendering apparatus for drying and calendering such board while in a continuous length, and before it is cut into sheets, so that the board is made and finished ready for the market by one continuous operation. The same arrangement of machinery may, by very slight additions, be adapted for the manufacture of several distinct and separate webs of paper at the same time. *Patent completed.*

1065. G. W. FULLER. *A new and useful or improved submarine lantern to be used in explorations beneath the surface of the ocean or any other large body of water.* Dated April 28, 1863.

This invention consists in producing a lantern which, when in use at whatever depth below the surface of the sea or a body of water in which it may be immersed, will have a pressure of air within it equal or about equal to the pressure of the water on its external surface, thereby enabling the patentee to construct a lantern of little strength and weight comparatively, one easily handled by a marine driver while in the water and below the surface thereof. *Patent completed.*

1066. J. H. JOHNSON. *Improvements in drying and cooling grain, and in the machinery or apparatus employed therein.* (A communication.) Dated April 28, 1863.

This invention relates to a mode or method of drying and cooling grain by the action of hot and cold air in suitable apparatus, and consists in the employment for the purpose of a box or kiln provided at its upper portion with a perforated metal, or with a web of fine wire-work, which extends over the entire area of the box or kiln, with the exception of a small slit or opening at one end of the box or kiln through which the dried grain escapes to the cooling apparatus. This perforated metal plate or wire-work is corrugated longitudinally, so as to form a series of parallel troughs or channels of a semicircular section, within each of which channels or troughs works an archimedian screw, or a shaft provided with a number of inclined blades, their object being when rotated to carry the damp grain along the perforated or reticulated surface. By making this surface in the form of a series of troughs, the hot air which enters below the same can penetrate the passing grain from the bottom and sides simultaneously, and so expedite the drying process. *Patent completed.*

1067. J. H. JOHNSON. *Improvements in apparatus for preserving property in case of shipwreck.* (A communication.) Dated April 28, 1863.

In carrying out this invention, it is proposed to construct the bag intended for the reception of letters or parcels of india rubber, gutta percha, or other flexible waterproof and air-tight mateaial suited for the purpose, and to rivet to each side of the mouth of this bag a metal jaw, the series or row of rivets extending not quite the entire width of the bag or length of the bar, so that the mouth may be readily opened for the introduction and removal of its contents. The jaws are rebated on the inner sides to accommodate the extra thickness of the material composing the bag at that part, and the inner heads of the rivets are covered by a strip of waterproof material to form a tight joint when the bag is closed. According to one mode of securing these jaws in a closed position, it is proposed to employ two or more swivel screw-bolts passing through both jaws, one of which swivels is provided with a locking arrangement for securing the bolt. *Patent completed.*

1068. G. S. MACDONALD. *Improvements in card-cases.* Dated April 28, 1863.

This invention consists in a method of constructing card-cases, whereby the card can be withdrawn without opening the case. *Patent abandoned.*

1069. T. MOORE. *Improved apparatus for laying down, protecting, and controlling submarine cables for telegraphing from vessels moored off a coast to the shore.* Dated April 28, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1070. R. BUTTERWORTH. *Certain improvements in carding engines to be employed for carding cotton and other fibrous substances.* Dated April 28, 1863.

This invention relates to that part of the carding engine known as the stripper, and is employed to strip the "fleece" or sheet of fibrous material fsom the "doffing cylinder." The invention consists in the employment and use of an internal shaft, having a number of pins or points arranged in several spiral lines or otherwise upon its periphery, and in enclosing such pins within a cylindrical casing, excepting at the point where they are required to protrude to strip the doffing cylinder, such casing being perforated with holes corresponding to the pins through which they emerge and retire. This exterior casing is placed eccentrically from the internal central shaft, its ends working on eccentrics, and it is also provided with an internal ring of teeth, taking with a pinion on the said shaft. The casing being thus driven by a band and pulley, causes the rotation of the shaft, both revolving together, but eccentrically to each other, which causes the pins to emerge in succession from the perforations at a certain point of the revolution to strip the fibrous matter from the "doffer," and to retire again within the cylinder, cleansing themselves against the sides of the perforation. *Patent completed.*

1071. G. DAVIES. *An improved machine for agitating and mixing substances.* (A commnnication.) Dated April 28, 1863.

This invention consists of two or more spiral or twisted rods or bars contained in a vessel of suitable form, one spiral rod being left-handed, and the other right-handed, or the rods being otherwise so formed and arranged and caused to so revolve as to produce separate currents in, and a thorough agitation and admixture of, the contents of the vessel. *Patent completed.*

1072. G. E. DONISTHORPE. *Improvements in apparatus used when getting coal and other minerals.* Dated April 28, 1863.

When using a carriage with picking or other cutting apparatus mounted thereon for getting coal and other minerals, it has been usual, in order to resist the vibration consequent on the regular successive impacts or actions of the picks or other cutting tools, to make the carriage of considerable weight; and the object of these improvements is to obtain the requisite stability and capability to resist vibration when a light carriage is employed. This it is propðsed to accomplish by applying a wheel or wheels to the carriage to act against the roof of the working, in addition to the wheels which rest on the rails or ways on which the carriage is moved from place to place, and such additional wheel or wheels is or are pressed elastically against the roof of the mine. This is most conveniently done by means of a piston in a cylinder containing compressed air, acting directly or by interposed levers on the axis of the wheel or wheels in contact with the roof; or other suitable means of obtaining the requisite pressure may be resorted to. *Patent completed.*

1073. H. Y. D. SCOTT. *Improvements in the manufacture of cementitious substances.* Dated April 28, 1863.

The patentee claims—1, subjecting the calcined mineral to the action of steam, purposely applied, as explained; 2, immersing the calcined mineral in water, or otherwise wetting it with water, and subsequently driving off the surplus moisture, or that which has not chemically combined with it, by means of heat purposely applied, and over and above that which is generated by the action of the water on the material, as described. *Patent completed.*

1074. S. S. MARLING. *Improved machine for scouring, washing, and cleansing woollen cloths and other fabrics.* Dated April 28, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1075. J. ROWLEY. *Improvements in the means or apparatus employed for recovering the fibres of wool from fabrics or materials composed of wool combined with cotton and other vegetable substances.* Dated April 29, 1863.

In carrying out this invention, the patentee first cleanses and then thoroughly saturates the woollen rags, fabrics, or other materials to be treated by steeping them in dilute acid (by preference, sulphuric), the strength being varied according to the nature of the materials to be operated upon. The rags or materials, after having had the steeping liquor discharged therefrom in any convenient manner, are placed (by preference for the purpose of being dried) in a rotating drum or cylinder made of wire gauze, or perforated metal or material, and a current of hot air is forced or drawn through them from a tube or flue suitably constructed for this purpose, by which means the rags or other materials are dried. The rags or materials having been thus dried, are deposited in boxes or trucks, and as they are deposited therein they are, by preference, intimately combined with, and embedded in, heated sand, previously prepared and cleansed from all oxidizable metallic substances at the same time. The boxes or trucks are then, by preference, raised to the upper storey of the building in which the operation is carried on, and after remaining in the hot sand or other material for a suitable length of time, according to the nature of the fibrous materials under operation, they are discharged, and the sand is separated therefrom by rotating sieves, or by other convenient mechanical means. The cotton or other vegetable substances contained in the fabrics or materials, after being treated as above described, will be so far destroyed as to be readily separated from the fibres of the wool previously combined therewith, the latter being unaffected by the process employed. *Patent completed.*

1076. E. ROWLAND. *Certain improvements in apparatus for weighing solid bodies and for measuring fluids, part of which improvements are applicable to the opening and closing of "dampers."* Dated April 29, 1863.

This invention relates to an apparatus for weighing solid bodies or measuring fluids wherein water or other fluid confined within a chamber is applied and employed as the counterbalance to the body to be weighed, such communicating chamber with a graduated tube to indicate the weight by the height of the water in the tube. A second part of the invention relates to a similar arrangement of apparatus to be employed to open and close dampers in the flues of a furnace employed to heat a steam boiler or generator; the rise and fall of the beam being effected through the medium of the water (instead of being adapted to weighing) is applied to the aforesaid purpose. *Patent abandoned.*

1077. W. and E. TARR. *An improvement in pianofortes.* Dated April 29, 1863.

This invention is not described apart from the drawings. *Pvtent completed.*

1078. W. E. GEDGE. *An improved system of permanent advertisement.* (A communication.) Dated April 29, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

1079. E. and F. A. LEIGH. *Improvements in cotton gins, and in the method of driving the same, part of which improvements is applicable to other purposes.* Dated April 29, 1863.

In that kind of gin called the Macarthy gin, the patentees place the doctor in a horizontal position, and cause it to press on the top of the roller instead of pressing against the side, as heretofore employed, the beater acting horizontally instead of vertically. This position admits of a vertical feed more conveniently (whether fed by hand or power), and causes the roller to bite or nip the cotton with greater certainty. They make the rollers in the ordinary manner, but place under the leather some elastic substance. The beater can either be actuated by a crank motion, or fixed upon springs; in the latter case, they cause a notched wheel to be fixed ou each end of the roller. These notched wheels or wipers have as many teeth as the number of strokes required of the beater for one of the roller—commonly five or six—so that when motion is given to the roller the notches, acting against steel pins or bowls fixed to the beater or to the springs, press it back, and allow the stroke to be made by the force or elasticity of the springs. This arrangement dispenses with the crank shaft. The next improvement is the application of a maintaining power for gins, and other machines turned by hand. This they accomplish by a small fly-wheel keyed on a light steel shaft, and accurately balanced. This shaft runs upon friction bowls having small steel gudgeons, and is turned by a strap from the gin roller or otherwise, so that it can be used or not at pleasure. In feeding the gin, they place a grid in a vertical position over the gin roller through which the seeds are pushed by the action of the beater. These gins may be made with one, two, four, or more rollers. *Patent completed.*

1080. W. RODGER. *Improvements in anchors.* Dated April 29, 1863.

This invention relates to those parts which are usually termed the crown, the arms, and the palms, and the object in view is to obtain a greater amount of strength and holding power with a given weight of iron. The additional strength is obtained by partly making the arms shorter than usual in proportion to the length of the shank—that is to say, about one-fourth part, instead of about one-third, and partly by their sectional form. The sectional form of the shank is rectangular at its junction with the arms, and square at the shank close to the collar for the stock. But the sectional form of the arms is widely different from that of any other anchor now in use, being of a wedge form, varying in sharpness from the throat to the head of the palms. The back part of the arms is made parallel from palm to palm, and is much thicker than their front part, which is tapered in the direction of the point; and the arms from the crown to the head of the palms being much broader in the direction of the strain than is usual, gives them a great increase of strength. *Patent completed.*

1081. H. WORMS. *Improvements in apparatus for elevating guns.* Dated April 29, 1863.

For the purposes of this invention, apparatus is applied at the hinder part of the gun carriage in the following manner:—Two toothed sector racks are used, which slide in guides below the rear end of the gun at their upper ends; these two sector racks are connected together by a bar or axis on which it is preferred to place a roller for the hinder part of the gun to rest upon. Motion is communicated to the two toothed racks by means of two toothed wheels on an axis turning in bearings carried by the two sides of the gun carriage. The axis and toothed wheels receive motion from another or driving axis or axes, on which there are two toothed pinions which take into and drive the toothed wheels on the first-mentioned axis. On the outer ends of the driving axis or axes are cranked handles, by which motion is communicated thereto. In order that the elevation of the gun may at all times be known, there are graduated ratchet discs or plates on the driving axis or axes, and a stop or catch to take into such teeth, and thus to retain the driving axis or axes from turning after being set, and such teeth are at regulated distances apart, so as to indicate (in degrees or parts of degrees) the elevation of the gun. *Patent completed.*

1082. M. BARLAND and E. H. C. MONCKTON. *Improvements in apparatus for withdrawing milk from cows and other mammiferæ, and for conducting it when withdrawn to appropriate receivers.* Dated April 29, 1863.

This invention consists in constructing a small tube or pipe of metal, electro-plated or otherwise, ivory, vulcanite,

ebonite, or other suitable substance, the diameter being about 3-16ths of an inch, more or less, and the length about 1½ to 3 in., more or less, one end being tapered to a conical or blunt point or head, and being perforated with several holes of an oval, round, or other shape. One of these tubes is to be inserted in each teat of the animal; and in some cases it may be necessary to keep the tube in position in the teat by means of an elastic band encircling the teat, and pressing it against the surface of the tube. So also the tubes may be secured against the danger of penetrating too deeply into the teat by means of a disc or small head plate fixed around the tubes near their lower ends. The effect of the insertion of these tubes will be that the milk will flow through the perforations into the tapered ends of the tubes, and, consequently, will pour through them in a regular and continuous stream until the milk is exhausted. The invention also consists in the employment of suitably constructed receivers for the reception of the milk, such receivers being somewhat of the form of the udder of the cow, and attached to the cow by straps or otherwise. *Patent completed.*

1083. F. GRETTON. *Improvements in heating the contents of mash tuns.* Dated April 29, 1863.

This invention consists in the combined employment of coils of pipes or heating cases, both at the lower part or bottom of the tun, and at or near the top surface of the wort or liquor contained in the tun, the surface pipes or heating cases being made to float by being connected to buoys or air-vessels. The inventor fits flexible pipes to the surface heaters to enable them to rise and fall with the contents of the tun, and he passes steam, hot water, or hot air through the pipes and heating cases. The invention also consists in heating the contents of mash tuns by means of pipes or cases made to float at or about the surface thereof, and supplied with steam, hot water, or hot air. *Patent abandoned.*

1084. G. HOLCROFT. *Improvements in the construction of pyrometers.* Dated April 29, 1863.

This invention consists in constructing pyrometers with a column of mercury acted upon by well-adjusted currents of heated air. *Patent abandoned.*

1085. H. W. RIPLEY. *Improvements in apparatus for printing fibrous materials.* (A communication.) Dated April 29, 1863.

This invention is more particularly applicable to the printing of fibrous materials which are afterwards to be drawn and spun into yarns, though fibrous substances may in like manner be printed after they have been spun, and these improvements may be used separately or in combination with suitable mechanism for drawing the fibrous materials before they are caused to be spun. The printing liquid is applied to a roller, the circumference of which is covered or coated with a porous cloth or material; the printing liquid is applied in such manner as to prevent there being any excess of colour upon the surface of the roller, or the excess of printing liquid may be expressed or removed from the outer surface of the soft and porous covering of the roller, in order that fibrous materials when they come in contact with the roller in the process of printing may not by the simple contact have colour transferred to them from the roller. For this purpose the inventor has in some cases used thick woollen cloth to cover the roller, and in other machines the roller has been covered with india rubber cloth, and over it thin woollen cloth. Both these modes of covering the roller have answered the purpose, but other elastic porous coverings may be employed. The colour is conveniently applied to the covered roller, by means of another roller partly immersed in the printing liquid, and revolving in contact with the covered roller so as to apply printing liquid thereto, and any excess of printing liquid is expressed either by a third roller or otherwise from the soft and porous coating of the covered roller. The printing is effected by means of a printing roller or surface on which the desired device is raised or engraved. This printing surface is employed to press the fibrous material against the covered roller, and the raised parts of the pattern press the fibrous materials into the soft and porous covering of the roller in which the colouring liquid is contained, and the fibrous material then receives colour from the roller. *Patent completed.*

1086. M. HENRY. *Improvements in apparatus for manufacturing beton and artificial stone, pugging clay, &c.* (A communication.) Dated April 29, 1863.

This invention mainly refers to the manufacture and application of a certain beton, composition, or artificial stone, for which François Coignet obtained British letters patent, respectively numbered 2,659 and 2,757, and dated 26th November, 1855, and 6th December, 1859. The invention first relates to improved machinery for manufacturing Coignet's patent beton or artificial stone, such machinery being also applicable for mixing concrete, pugging clay, working mortar, and other similar purposes. Machines hitherto constructed for these objects have been provided with one or two small ejection orifices, through which the materials were forced out or discharged. Now, according to this invention, the machine is formed with an ejection opening extending continuously, or nearly continuously, or without, or nearly without, division or break round the discharge end of the machine. Or large or numerous, or both large and numerous, ejection openings are distributed all round that end of the machine. By these means the materials, after having been mixed, pugged, or treated in the machine, are discharged therefrom freely and continuously with little or no obstruction or resistance. The chamber or casing of the machine is constructed of three parts—in one of which the ejection openings are below the two others, and one of these latter is removeable, so that the chamber may be easily cleansed. In this chamber a shaft revolves, carrying appliances for mixing, kneading, or otherwise acting on the materials, and others for pressing, drawing, or heaping them towards the ejection orifices, and for discharging them therefrom. The passage through the ejection orifices may be regulated by an annular valve. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated October 9, 1863.

2480. D. Lange, 5, Trinity-square, Tower-hill. Certain improvements in railway wrappers.

Dated October 20, 1863.

2568. M. Petenkofer, professor of chemistry, Bavaria. Restoring the surface of pictures in oil without any danger to their original state.

Dated October 22, 1863.

2599. F. Bullock, rear-admiral, 16, Richmond-terrace, Gravesend. Improvements in ships' logs or apparatus for ascertaining the speed of ships.

Dated October 31, 1863.

2702. W. Law, Northampton, cabinet manufacturer. Improvements in the construction of articles of furniture known as wardrobes, including improved arrangements for attaching doors to the same, such improvements in attaching doors being applicable to other articles of furniture.

2708. E. Jones, Charlton. Improvements in the manufacture of bricks, drain pipes, traps, sewage tanks, and water-closet pans and valves, and the machinery and apparatus necessary for the same.

Dated November 3, 1863.

2715. D. Davy, jun., Sheffield, engineer. Improvements in steam hammers.

Dated November 4, 1863.

2733. W. Audinwood, Castle Donington, Leicestershire. Improvements in thrashing machines.

Dated November 5, 1863.

2735. G., W., and J. Craven, Vauxhall Iron Works, Manchester, engineers and tool makers. Improvements in machinery for cutting and planing iron and other metals, particularly applicable to machinery for cutting and planing armour plates.

2740. B. Blackburn, Chelsea, esquire. An improved coupling or buckle.

Dated November 6, 1863.

2752. R. Sellar, Huntley, Aberdeenshire, agricultural implement manufacturer. An improvement in the construction of harrows.

2760. W. D. Allen, Laithfield-house, Norfolk-road, Sheffield, steel manufacturer. Improvements in casting ingots of steel.

2764. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in sewing machines. (A communication.)

Dated November 7, 1863.

2770. J., J., and G. W. Dyson, Tinsley, Yorkshire, ironfounders. Improvements in the method of, and machinery for, forming metal plates, bars, and rods taper.

2776. C. D. Abel, 20, Southampton-buildings. Improvements in apparatus for raising and lowering bodies. (A communication.)

Dated November 11, 1863.

2798. F. Testuz, 11, Air-street, Piccadilly. Improvements in breaks applicable to railway and other carriages.

2800. W. R. Bowditch, St. Andrew's, Wakefield, clerk. Improvements in apparatus used in gas-lighting.

Dated November 12, 1863.

2811. H. J. Simlick, Old Ford-road, Bow. Improvements in the manufacture of fusees or matches employed to light cigars and pipes.

2813. B. Peake, Coventry, ribbon manufacturer. Improvements in the manufacture of neck ties, cravats, and waistbands, which improvements are also applicable to other articles of wearing apparel.

2815. A. Illingworth, Bradford, Yorkshire, spinner. Improvements in means or apparatus employed in preparing and twisting cotton wool and other fibrous materials.

2817. G. Davies, 1, Serle-street, Lincoln's-inn. Improvements in springs for railroad cars and other similar purposes. (A communication.)

2821. G. H. Brockbank, Great College-street. Improvements in pianofortes.

2823. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in gas burners. (A communication.)

2825. D. M. Fyfe, Maidenhead, adjutant of the 19th Regiment of Berks Volunteers. Improvements in carriages and apparatus for raising, removing, and transporting heavy bodies from place to place.

Dated November 13, 1863.

2827. B. Marriott, 38, Upper-street, Islington, and C. Radcliff, 201, Hampstead-road. Improvements in dead beat independent centre seconds watches.

2829. W. Chambers, Whitefield, near Manchester, bleacher. Improvements in machinery for beetling and finishing cloth.

2831. H. F. Hodson, 179, Western-road, Brighton, agricultural agent. Certain improvements in cigars.

2833. E. Spencer, Oldham, machinist, and J. Dodd, machinist. Improvements in mules for spinning and doubling.

2837. T. Harrison, Tudhoe, near Ferry-hill, Durham, mechanical engineer. Improvements in machinery for cutting and excavating coal and other minerals, applicable also to other mining purposes.

Dated November 14, 1863.

2841. De B. Hughes, Liverpool, scenic artist. Improvements in producing dramatic and other like effects on the stage or in a room.

2843. J. Ellison, Leeds. Improvements in flour dressing machines, termed "silk reels."

2847. A. Ellissen, City of London, merchant. Improvements in preventing the fouling of the bottoms and sides of ships and vessels, particularly applicable to ships and vessels constructed of, or sheathed with, iron.

2849. G. Barker, 59, Broad-street, Pendleton, merchant. Improvements in the construction of syphons for taking off liquid sewerage, overflow of rivers, and other like purposes.

2851. G. H. Courtney, Broadway, Stratford, Essex. Improvements in tills or receptacles for money.

2853. G. Lindemann, Salford, engineer. Improvements in machinery or apparatus for singeing woven fabrics.

2855. L. Mackirdy, Greenock, sugar refiner. Improvements in saturating, washing, and cleansing charcoal and other matters, applicable also to the separation of syrups from sugar.

2859. J. Southgate, 75 and 76, Watling-street. Improvements in overland and other portmanteaus.

2861. J. Walmesley, Berlin, Canada, farmer and waggon maker. Improvements in machinery for pulverizing and cleaning the soil, and scattering seed, guano, bone dust, and other substances thereon.

Dated November 16, 1863.

2863. E. and F. A. Leigh, Manchester, mechanical engineers. Improvements in the method of driving and feeding cotton gins and of conveying away the ginned cotton and seeds therefrom.

2865. S. Cameron, plumber, and W. Johnston, metal merchant, Glasgow. Improvements in taps or valves in pipe joints, and in the valvular mechanism of water-closets

2871. I. Pomès, Condon, France, gentleman. An improved hydraulic motor.

2875. R. A. Brooman, 166, Fleet-street, patent agent Improvements in the manufacture of salt, and in boilers to be fed by salt water. (A communication.)

Dated November 17, 1863.

2877. F. W. Burton, 20, Somerset-place, New North-road, ornamental carver. Improvements in the construction of music stools, tables, and other articles of furniture, and in means of securing such articles to floors.

2879. V. Baker, lieut.-colonel of Her Majesty's 10th Regiment of Hussars, Dublin. Improvements in breech-loading ordnance, and in apparatus connected therewith.

Dated November 18, 1863.

2881. W. Pratchitt, J. Blaylock, and J. Pratchitt, Carlisle, machinists. Improvements in, and applicable to, moveable platforms for railway stations.

2885. R. W. Siever, Guildford-street, Russell-square. Improvements in jacquard machines. (A communication.)

2887. J. R. Cooper, Birmingham, gun manufacturer. Improvements in the manufacture of barrels for firearms, and in machinery to be used in the said manufacture.

2889. J. Elder, Glasgow, engineer. Improvements relating to floating and other docks.

2891. J. Mackew, Leicester, machinist. Improvements in machinery for making looped fabrics.

2893. J. G. Jennings, Palace-road, Lambeth, sanitary engineer, and M. L. J. Lavater, Bath-street, Newgate-street, india rubber manufacturer. Improvements in the manufacture of tubes, rings, and cords of india rubber, and in covering telegraph wires.

2895. P. St. G. Groome, 9, Waterloo-place, Pall Mall, captain R.A. Improvements in ships or vessels for war and other purposes.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated November 18, 1863.

2884. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in rotary engines. (A communication.)

Dated November 20, 1863.

2926. H. A. Bonneville, 38, Porchester-terrace, Bayswater. Improvements in preserving grain, flour, and other substances, and in the apparatus connected therewith. (A communication.)

Dated November 21, 1863.

2941. J. Steart, 5, St. James-road, Bermondsey, manufacturer. Extracting the fibre from zostera marina and other aquatic vegetable productions.

Dated November 24, 1863.

2950. St. G. Gregg, 3, Austin-friars, and T. Gray, Mitcham, bleacher. The production of thread, cordage, and woven textile fabrics from prepared fibre of hemp, or any of the plants known of the order or genus "Canabis," and in mixing such prepared fibre with cotton, silk, or animal wool.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, December 1, 1863.

1810. R. B. Brassey and J. Hargreaves. Sizing and drying yarns.
1812. J. and W. H. Bailey. Prevention of boiler explosions.
1814. W. E. Gedge. Inland navigation. (A communication.)
1821. C. H. Roeckner. Paper stuff or pulp.
1823. W. L. Aberdein. Preparing flax.
1825. E. T. Bainbridge. Ventilators.
1829. E. Alcan. Condensing steam. (A communication.)
1833. J. Ronald. Preparing hemp for spinning.
1834. C. Senior. Hose pipes.
1839. J. Simmons. Ploughs.
1840. W. Cole. Securing the safety of persons in window-cleaning.
1852. A. English. Securing cattle during transit.
1854. B. Birnbaum. Gaiters and leggings.
1864. T. Thorne. Disengaging ships' boats.
1865. G. Haseltine. Coal-oil lamps. (A communication.)
1868. J. Whittaker. Obtaining motive power.
1886. J. T. Stephens and C. Hoare. Yarns.
1895. J. P. Culverwell. Railway lamps.
1914. B. W. Gerland. Size.
1934. A. V. Newton. Stereotype plates. (A communication.)
2075. J. Eccleston. Economizing water power.
2081. E. Pope. Breech-loading firearms.
2093. L. Guillemot. Obtaining perpetual motion.
2172. F. C. P. Hoffmann. Crushing hard substances.
2389. W. Clark. Soles of boots. (A communication.)
2405. F. Reid. Collecting the spirit generated by spontaneous fermentation in raw sugar during boiling.
2441. S. Mathews. Breech-loading firearms.
2444. R. A. Brooman. Steam boilers. (A communication.)
2596. A. A. Croll. Disinfectants.
2600. J. Mitchell. Sinking and excavating.

2606. W. W. Burdon. Paper.
2671. G. E. Donisthorpe. Apparatus used when getting coal.
2744. H. Bessemer. Railway bars.
2745. S. Smith. Safety valves.
2746. H. Bessemer. Malleable iron and steel.
2749. F. E. Sickels. Steering and turning vessels.
2758. J. Townsend. Nitrate of potash.
2766. T. C. Barraclough. Looms for weaving. (A communication.)
2781. H. Mège. Soap.
2806. W. D. Richards. Caloric engines. (A communication.)
2859. J. Southgate. Portmanteau.
2889. J. Elder. Floating docks.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed November 27, 1863.

1356. F. Patureau.
1371. H. C. Coulthard.
1373. A. Illingworth.
1375. G. H. Cottam.
1377. G. A. Barrett, W. Exall, C. J. Andrewes, and A. Barrett.

Sealed December 1, 1863.

1384. J. Travis.
1389. F. S. Barff.
1393. S. Blake, T. Lee, and R. Dutton.
1394. H. Rigby.
1401. A. Q. de Gromard.
1402. R. A. Brooman.
1404. J. Seaman.
1406. J. H. Johnson.
1439. H. Bessemer.
1449. W. Clark.
1495. I. B. Harris.
1503. W. Mainwaring.
1577. J. Ellison and A. Rogerson.
1597. A. Ripley.
1630. A. Silvester.
2173. C. Jackson.
2237. W. Taylor.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1827. E. T. Hughes.
2904. I. Sharp and W. Bulmer.
2907. J. S. Manton and T. Islip.
2924. N. Ager.
2952. J. Ronald.
2957. W. P. Piggott.
3002. W. Clark.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2828. L. C. Stuart.
2831. J. L. Clark.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending November 28, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
697	2 10	739	0 4	758	0 8	767	0 8	776	0 4	786	0 4
699	1 2	745	0 8	759	0 4	769	0 8	777	0 4	787	0 8
702	0 8	749	0 10	760	0 4	770	1 0	778	0 4	788	0 6
706	0 4	750	0 10	762	0 8	771	0 4	779	0 4	789	0 8
715	0 10	751	0 8	763	0 4	772	0 4	780	0 4	791	0 8
721	1 4	754	2 0	764	1 0	773	0 4	782	0 10	792	0 8
727	0 8	756	1 10	765	1 8	774	0 4	783	0 4	793	0 4
737	1 4	757	1 2	766	0 4	775	0 4	784	0 4	794	0 4

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
May 6,	4555	J. Gunner, Enfield	Ramrod.
,, 7,	4556	H. Twelvetrees, Bromley	Mangle.
,, 8,	4557	G. Hazelton, Birmingham	Locket-case.
,, 13,	4558	W. Blott, New Oxford-street	Photogrphc.printing frame.
,, 20,	4559	H. Hanly, Regent's-park Barracks	Incubator.
,, 26,	4560	R. Rains, Blackfriars	Machine for freezing.
,, 30,	4561	S. T. Bateson, Bolton-street, W.	Pipe.
June 1,	4562	W. Tonks and Son, Birmingham	Pulley.
,, 1,	4563	F. Hall, Worcester	Meat safe.
,, 2,	4564	G. Lloyd, Birmingham	Insect trap.
,, 2,	4565	W. Tonks and Son, Birmingham	Call bell.
,, 4,	4566	A. L. Salomons, St. Paul's-churchyard	Waistbelt.
,, 9,	4567	M. L. Jacob and L. Woolf, Birmingham	Slide for scarfs.
,, 20,	4568	W. H. Tuffrey, Cornwall	Plough.
,, 26,	4569	G. Wright and Co., Rotherham	Kitchener.
July 3,	4570	F. Barker, Hammersmith	Packets of paper.
,, 18,	4571	T. T. Topling, Sunderland	Fire-bars.
,, 18,	4572	H. Bell, Birmingham	Hob-nail.
,, 20,	4573	H. Gillott, Birmingham	Easel.
,, 29,	4574	B. Miller, Leeds	Steamengine standard.
Aug. 6,	4575	W. Oxley, Manchester	Steam trap.
,, 7,	4576	W. B. Lord, Sandgate	Cartridge case.
Sep. 14,	4577	C. Smith, Union-st., E.C.	Child's normal.
,, 14,	4578	G. P. Hill, Wood-st., E.C.	Button gauge.
,, 18,	4579	H. Gaball, Burlington-gardens	Chest protector.
,, 24,	4580	J. L. Thomas and Co., Exeter	Lamps.
,, 28,	4581	J. Kenney, Birkenhead.	Water Tue-iron.
,, 30,	4582	H. J. & D. Nicoll, Regent-street	Wing cape.
Oct. 6,	4583	J. Parkes, Handsworth.	Handle.
,, 6,	4584	C. Rowley & Co., Brmghm	Buckle.
,, 9,	4585	T. P. Hawkin, Brmghm.	Hooks.
,, 15,	4586	R. Howson and E. F. Jones, Middlesboro'	Blast cylinder.
,, 17,	4587	J. F. M. Hawkins, Nrthall	Feeding trough.
,, 19,	4588	J. E. Maddox, University-street	Bed bath.
,, 24,	4589	P. Hughes, Paddington	Counter box.
Nov. 2,	4590	W. N. Nicholson, Newark	Wine bin.
,, 4,	4591	W. J. Gilbert and Co., Birmingham	Box iron.
,, 6,	4592	H. J. Cave, Edward-st. W	Portmanteau.
,, 7,	4593	S. and T. Carrington, Stockport	Ventilating.
,, 9,	4594	H. Elliott, Birmingham	Firearms.
,, 9,	4595	Mechi & Basin, Regent-street	Dressing bag.
,, 13,	4596	T. R. Withecombe, Manchester	Tobacco pipe.
,, 21,	4597	W. Brown, Glasgow.	Sofa bench.
,, 21,	4598	T. Atkins, Birmingham	Fastener for tables
,, 27,	4599	T. Evans, Pentonville-rd.	Dome of parasol.
		PROVISIONAL REGISTRATIONS.	
May 1,	1442	W. Oliver, Bath-street	Watch protector.
,, 11,	1443	J. Harper, Powick	Cravat.
,, 18,	1444	Carthian and Corbiere, Cannon-street	Buffet de Garcon.
,, 21,	1445	R. A. Margetson, Norwich	Flyer and handle.
,, 28,	1446	H. Heyes, Chichester-rents, E C.	Copying press.
,, 29,	1447	T. Thomas, Regent-street	Landing stage.
June 2,	1448	C. Blackman, Regent's-park Barracks	Crib-biting preventor.
,, 9,	1449	T. Hickin, Birmingham	Syringe end.
,, 9,	1450	W. Lee and Co., Cannon-row, S.W.	Machine for ginning cotton.
,, 17,	1451	J. Marples, Sheffield	Setting saws.
,, 24,	1452	J. Norcott, Mrylebone-rd	Carriages.
,, 24,	1453	T. H. Webster, Dublin	Spring boot.
,, 26,	1454	G. Benton and J. Stone, Birmingham	Water spreader.
,, 30,	1455	W. Baddeley, Islington.	Valve strainer.
July 4,	1456	C. Young, Edinburgh	Curling Rink.
,, 9,	1457	W. Riddle, Sth. Lambeth	Candlestick.
,, 13,	1458	S. B. Solomons, Albemarle-street	Spectacles.
,, 16,	1459	F. J. Campbell, Lower Thames-street	Boxes for wine.
,, 29,	1460	J. G. Winton, Southwark	Cistern.
,, 31,	1461	T. Spenceley, Wandsworth-common	Fastener for scarfs.
Aug. 1,	1462	T. Simmons, Birmnghm.	Watering can.
,, 8,	1463	T. Bissell, Tooley-street	Heel pad.
,, 12,	1464	H. Gaball, Burlington-gardens	Spine protector.
,, 14,	1465	J. G. Winton, Gladstone-street	Gland for tubes of surface condensers.
,, 15,	1466	T. Simmons, Birmnghm.	Fumigator.
,, 27,	1467	E. Samson, Shoreditch	Music stool.
,, 31,	1468	W. Lewis, Cheapside	Scarf ring.
Sept. 1,	1469	J. Halford, Harleyford-rd	Testing socket.
,, 2,	1470	W. Gill, Ipswich	Gas shade.
,, 3,	1471	C. Smith, Borough	Child's normal.
,, 7,	1472	J. Lyons, Wilson-st, E.C.	Inverness cape.
,, 11,	1473	J. H. Radcliffe, Oldham	Lubricator.
,, 12,	1474	W. Moss, Old Kent-road	Socket-pipe joint.
,, 16,	1475	W. Gill, Ipswich	Ribbon reel.
,, 17,	1476	J. Waddie, Edinburgh	Envelope.
,, 17,	1477	J. Zobel, Euston-road	Wire frame.
,, 26,	1478	J. F. M. Hawkins, Nrthall	Feeding trough.
,, 29,	1479	J. Harper, Powick	Self-packing hamper.
Oct. 2,	1480	G. Davis, New Oxford-st.	Regulator.
,, 5,	1481	T. Bousfield, St. Mary Axe	Skirt.
,, 7,	1482	G. Askie, Wellington-st.	Wringingmachine
,, 7,	1483	E. Holding, Duke's-crt., W.C.	Double action cock
,, 12,	1484	E. Butes, Cross-street	Band fastening.
,, 13,	1485	W. Talley, Bletchley	Shaft guard.
,, 14,	1486	J. Thomas, Holland-st. S.	Coffee maker.
,, 16,	1487	J. Cadwallader, Madeley	Stud rivet.
,, 20,	1488	J. G. Austin, Rake	Dripless hem for coats.
,, 29,	1489	T. Kendrick, Birmnghm.	Lock furniture.
Nov. 5,	1490	J. G. Winton, Gladstone-street	Flange valve seat.
,, 25,	1491	J. H. Simpson, Ireland.	Cup toe-sheath.
,, 26,	1492	Sharman & Smith, Rugby	Chimney top.
,, 27,	1493	W. Smith, Durham	Grass-cutting machine.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£ s. d.		£ s. d.	
Iron:—					
Welsh Bars, in London	per ton	7 10 0	to	0 0 0	pct
Nail Rods	do	8 0 0		8 10 0	
Hoops	do	10 10 0		0 0 0	
Sheets, single	do	£11 10 0		0 0 0	
Staffordshire Bars	do	9 10 0		0 0 0	
Bars, in Wales	do	6 10 0		6 15 0	
Rails	do	7 0 0		0 0 0	
Foundry Pigs, at Glasg, No 1	do	3 0 0		3 6 0	
Swedish Bars	do	11 10 0		12 10 0	2½
Steel:—					
Swedish Keg, hammered	do	16 0 0		16 10 0	
Swedish Faggot	do	17 0 0		18 0 0	
Copper:—					
Sheet & Sheathing, & Bolts	do	105 0 0		0 0 0	
Hammered Bottoms	do	115 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	110 0 0		0 0 0	
Tough Cake and Ingot	do	98 0 0		0 0 0	
Tile Copper	do	98 0 0		0 0 0	
Best Selected	do	101 0 0		0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½		0 0 0	
Fine Foreign	per ton	100 0 0		103 0 0	
Tin:—					
English Block	per cwt.	5 15 0		0 0 0	2½
do Bar	do	5 16 0		0 0 0	
do Refined	do	6 0 0		0 0 0	
Banca	do	6 2 0		6 3 0	nett
Straits	do	5 17 0		0 0 0	
Tin Plates:—					
Best Charcoal, I.C.	per box	1 9 0		12 0	
Second Quality	do	1 7 0		8 0	
Coke	do	1 3 6		6 0	
Spelter:—					
On the spot	do	18 7 6		0 0	nett
Zinc:—					
English Sheet	do	24 0 0		0 0 0	2½
Quicksilver	per btl.	7 0 0		0 0 0	3
Regulus of Antimony:—					
French star	per ton	35 0 0		0 0 0	2½

Timber, duty 1s. per load, drawback 1s.

Teak	load £12 0	£13 0		Archangel, yellow	£13 0	13 10
Quebec, red pine	3 10	4 10		St. Petersburgh, yel.	11 10	12 0
,, yellow pine	3 10	4 10		Finlan	9 0	10 0
St. John, N.B., yellow	0 0	0 0		Memel	10 0	15 0
Quebec oak, white	5 10	6 10		Gothenburg, yellow	10 0	11 0
,, birch	3 10	4 10		,, white	9 0	9 10
,, elm	3 10	5 0		Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10		Soderhamn	9 10	10 10
,, fir	2 10	3 10		Christiania, per C., 12ft. by 3 by 9 in.		
Memel fir	3 5	3 10		Christiania, yellow	21 0	23 0
Riga	3 0	3 5		Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 1
Swedish	2 10	2 15				
Masts, Quebec red pine	5 0	6 0				
,, yellow pine	5 0	6 0		Pumice Stone pr ton	5 10	9 0
Lathwood, Dantzic, fm	5 10	6 10		Oils, &c.		
,, St. Petersburg	8 0	8 10		Seal, pale ...per tun	47 10	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				Sperm body	77 0	78 0
				Cod	56 0	0 0
				Whale, Sth Sea, pale	45 0	46 0
Quebec, white spruce	15 10	18 10		Olive, Gallipoli	58 10	59 0
St. John, white spruce	14 0	15 10		Cocoanut, Cochin	47 0	47 10
Yellow pine, per reduced C.				Palm, fine	36 10	0 0
				Linseed	37 10	0 0
Canada, 1st qual.	17 0	18 0		Rapeseed, Eng. pale	41 0	0 0
,, 2nd do.	11 0	12 0		Cottonseed	31 0	35 0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number:—

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 11, 1863.

THE CATTLE SHOW.

UNDOUBTEDLY the event of the week has been the Smithfield Club Cattle Show, and this not only as regards London, but, to a great extent, the country at large as well. Periodical exhibitions of stock and implements, affect the interests of both the farmer and the agricultural engineer very considerably, forming as they do constantly recurring records of progress and stimuli to renewed exertion, which have been up to the present highly conducive to the welfare of the community who make mother earth serve them directly with the comforts, as well as the necessaries of daily life. With the recollection of the Worcester Show fresh in the mind, the visitor to the Agricultural Hall, at Islington, may not have found much that was new, but he will surely have fonnd a great deal that was good, albeit devoid of the peculiar charm which is said to hang round novelties. It is probable that country gentlemen have recognized many an old face (we were about to say old friend) within the precints of the cattle pens; and we, who confess to feeling little interest in that department, have certainly met with many an old friend in the shape of mechanical contrivances and arrangements, among the implements. "There is nothing new under the sun," said a wise man of old; and it would seem that the proverb is especially applicable to the works of the agricultural engineers just now. As a class, they seem inclined to rest from the labour of originating new things, for the present preferring to go on improving on existing devices, rather than plunge into the cold bath of invention. Perhaps, it is better so; the creation, so to speak, of a new implement, which shall possess sufficient good in itself to enchant a discriminating public, being anything but an easy task. After all, your thorough English farmer is not very easy to please, and is usually captious and critical enough to render the path of the inventor whotries to supply his wants, real or imaginary, sufficiently thorny and rugged, to make the expediency of entering on it at all, a thing to be thought about two or three times. Nevertheless, there are prizes to be drawn in agricultural engineering, as well as in any other pursuit; and when once a plough or a thrashing machine, a steam engine or a cultivator, has borne the test of experience, it is certain that want of appreciation will not cause a slack sale. Notwithstanding a little crustiness now and then, the English country gentleman is a pleasant fellow to work for; and he and the engineer have got on very well togetherso far; and we see no danger of the harmony being interrupted.

The Agricultural Hall, at Islington, appears to us to be, in every respect, thoroughly well adapted to the purpose in view. Our readers are probably aware that its erection, or at least completion, is comparatively recent. The Smithfield Club Show, of 1862, in December, being the first Exhibition held within its walls. It consists of a very well proportioned hall, covered in by a handsome iron roof of considerable span, and surrounded by wide galleries supported on cast-iron pillars, to which easy access is attained by numerous staircases. These galleries are devoted, just now, to the smaller implements—such as chaff-cutters, root-pulpers, light reaping machines, and samples of cereals, roots, and artificial manures. For all these things there is ample room—a circumstance highly conducive to the comfort of both visitors and exhibitors. Would that we could say as much of the ventilation. The centre of the large area below is divided by iron rods, into compartments devoted to sheep and horned cattle; while the space under the galleries is pretty well filled up by the heavier class of agricultural machinery. Here, again, there is a total absence of crowding; most of the exhibitors having had the good taste to avoid a mere display of a multitude of implements, of the merits of which no one, however privileged, could by any possibility judge without great exertion and some personal risk. The means of obtaining access to the Hall were on the whole good, though by no means incapable of improvement. On Monday especially, the crowding at the exhibitors' and ticket entrance was very unpleasant, and called forth many animadversions on the arrangements.

Anything like a detailed description of the implements exhibited, would at once exceed our space, and prove uninteresting. Literally speaking, the visitor might walk through the building east and west, north and south, without discovering anything very new. Perhaps the most remarkable feature of the Exhibition lies in the self-propelling engines. In the International Exhibition of 1851 there was not one traction engine; and it is not perhaps saying too much, to state that a general belief existed that none could be contrived to answer any commercial purpose. All that is changed now; and, both in England and in the colonies, road locomotives, day by day, act a more prominent part. Our readers will doubtless recollect what an important class they formed at Kensington last year, and some progress has been made since. Makers of this description of steam machinery daily become more enterprising, and the dimensions of three or four of those shown at Islington, would have put the railway locomotives of twenty years ago to the blush. Messrs. Aveling and Porter, Garrett, Clayton and Shuttleworth, Fowler, and Howard are exhibitors in this class. The workmanship of their engines is generally speaking good, although individual arrangements are not yet all that they should be. In the first rank we must place an 8-horse engine, by Messrs. Aveling and Porter, which appears to us to meet almost every possible requirement in the most efficient manner. Perhaps there is not at present a firm in existence which has had so much practical experience in the road locomotive. Although their engines are, comparatively speaking, a thing of yesterday, Messrs. Aveling and Porter have completed altogether ninety-seven engines of the kind, ninety-six of which are in use. The engine exhibited is of 8-horsepower, according to the method of calculation adopted by the Royal Agricultural Society, having a 9-in. cylinder by 12 in. stroke. The gross weight full, is about 9·5 tons. The general arrangements are too well understood to need description; and the only novelties embraced in the present engine are a simple modification for obtaining two speeds, and an improved method of taking up the slack of the chain. Close behind the fly-wheel shaft a second is placed, carrying two spur wheels of different diameters, which are put in motion by pinions on the fly-wheel shaft. Either of these wheels can be placed in gear by simple means, according as the fast or slow speed is required; the other, of course, being thrown out for the time being. This spur-wheel shaft is supported in brasses, which can be moved up and down as occasion requires in curved brackets bolted to the boiler. These brasses rest on iron packing pieces of various thicknesses. When the chain becomes too slack by wear, it is only necessary to raise the shaft and brasses in the curved plummer blocks, and replace a thin packing piece by one a little thicker, to take up the slack of the chain. The whole arrangement is kept tight by suitable set screws, and answers its purpose in the most efficient manner; it being impossible, with the most moderate amount of care, to put the second shaft out of parallelism with the first. The chain is made with solid block links 2 in. wide, each finished in the shaping machine. Thus, a large bearing surface is provided, and wear is reduced to a minimum. It may not be out of place to state that one of these engines, of a somewhat larger size, has travelled over 5,000 miles of country roads, and is still a very efficient machine, having on one occasion drawn 26·5 tons, in addition to its own weight, up an incline of 1 in 12, 502 yards long, a performance almost unique.

Messrs. Garrett and Son show a very neat single cylinder 8-horse self-propeller, embodying Mr. Aveling's patents. The cylinder is placed in the smoke-box just beneath the chimney. This engine is without the double speed gearing. The driving wheels are 3 ft. 6 in. high, and very wide on the face. It is the only road locomotive in the Exhibition provided with springs, if india-rubber blocks, fitted in a very simple and ingenious axle-box deserve the name. It is strange that engineers should willfully shut their eyes to the advantages to be derived from the interposition of a flexible medium between the dead weight and the carrying wheels. It is in vain to urge that, at slow speeds, expedients of the kind are unnecessary. We never could understand why speed should be kept down to the same rate with an unloaded as with a loaded engine. One of the best traction engines we ever met with, could draw 30 tons comfortably on a good road at 2½ miles per hour, and run light, at from 7 to 8 miles with the greatest ease, thanks to the long easy springs so universally eschewed. That they form an item of expense at first, we admit; but the saving which they effect in the subsequent outlay for repairs far exceeds their first cost. Messrs. Garrett also show a well-arranged double cylinder portable 12-horse engine; a 13-row corn drill; a very good finishing thrashing machine, with a single fan on the drum shaft; and several other articles, the workmanship of which is quite good enough to maintain the well-earned reputation of the firm.

Clayton and Shuttleworth exhibit a traction engine, intended for Egypt; the cylinders, 8·5 in. diameter, by 14 in. stroke, are placed in the smoke-box just beneath the chimney; the driving wheels, nearly 7 ft. high, have cast-iron cellular rims and wrought-iron spokes. The general arrangements of the machine are very good, and the workmanship excellent. The driving gear is so very peculiar, that, without drawings, it would be impossible to give an accurate idea of it. Suffice it is to say, that the driving wheels each revolve loose on the main axle, which is immoveable. Just in the rear of the boiler, and at a convenient height above the fire-door, runs a transverse shaft, carrying a differential system of gearing at the ends. This shaft is driven by a pitch chain from the crank axle. Inside each driving wheel is bolted a large spur wheel, put in motion by the transverse shaft and differential wheels. The whole affair looks complicated, but is really very simple. The effect produced is, that so long as the resistance is the same to both drivers, they will

both be propelled with equal velocity. If, however, the engine is in the act of turning a corner, the inside wheel will simply remain at rest, or nearly so, because the action of the steering gear places an obstacle in the way of its progress; the outside wheel will then advance at a speed as much greater than its normal velocity, as that of the inside wheel is less. Thus, if one wheel were blocked, the other wheel would proceed at a double velocity, the engine shaft still making only the same number of revolutions; and this action is so perfect, that the steering is effected with the greatest possible ease. The whole arrangement is extremely ingenious, and being well carried out with cast-steel pinions, &c., should prove very durable. The steering is effected by an endless screw and pitch chain; the principle involved being none of the best, inasmuch as the screw offers a nearly rigid *point d'appui* to any force impressed on either fore wheel by obstructions on the road, and the chances of striping the teeth of the worm wheel are materially increased, in consequence. While speaking of the fore carriage and its connections, we may remark that no universal joint arrangement is provided to permit either end of the axle to rise or fall independently of the engine. This may seem trifling; but it is on such trifles that the success of the road locomotive depends. It is folly to attempt to compel an engine to proceed over irregular ground on four rigid points of support. A swivel joint in front obviates the difficulty by reducing their number to three; the entire machine is spared many a strain thereby, and the operation of steering is greatly facilitated. Messrs. Clayton and Shuttleworth also exhibit a double cylinder stationary engine, fitted with expansion gear; a thrashing machine; portable engines, &c., of excellent workmanship and good design.

Messrs. John Fowler and Co.'s stand presents little with which the public are not perfectly familiar, save a rather coarsely-got-up traction engine, intended to carry an underneath clip drum. The driving gear is completely boxed up within a heavy plate-iron inclined trunk, carrying the outside bearings of the shafts, so that it is not very easy to determine what it is like. The steering gear is in one sense extremely neat and compact, yet as unmechanical and defective in principle as it well can be. A large hand wheel on the foot plate, far removed from any bearing, puts an endless screw in motion, through the medium of some gearing and an inclined shaft about 18 ft. long. The endless screw takes into a very small, quadrantal, toothed arc on the fore carriage. This certainly does not look like good engineering. The foot plate of a traction engine is generally far too small to render it advisable that the steersman should discharge his duties there. So long as a locomotive is intended merely for ploughing, the arrangement may be tolerated, because the engine-driver can guide the engine forward for the few yards required at a time. The machine in question, is, however, set forth as a traction engine to which the winding drum *may* be attached, if deemed desirable; and such being the case, the steering wheel has no business on the foot plate. An engine and windlass, similar to that shown last year at Kensington; a set of ploughs, cultivators, &c., are highly creditable to the makers, and appeared to meet with thorough appreciation from the public.

Messrs. Howard exhibit a set of their patent steam-cultivating apparatus, including, of course, the inevitable 10-horse self-pro... by Clayton and Shuttleworth, and very similar in every respect, save the absence of differential gear, to the one shown by that firm and already described. The workmanship of all these articles is above the average. The merits of the system are too well known to require comment.

Messrs. Hornsby and Son exhibit a very highly finished double cylinder portable 10-horse engine, suitable for ploughing or other purposes. The cylinders are placed in a steam chest over the fire-box. The propriety of using longitudinal wrought-iron stay rods from the cylinder covers to the crank-shaft brackets, is more than doubtful. The boiler must expand far more than they can, removed as they are from any direct source of heat; hence, a tremendous strain must be exerted on the cast-iron brackets, which appear to be quite strong enough in themselves to support any legitimate strain to which they may be exposed, without the aid of such questionable expedients. We noticed a very ingenious and carefully got up reaping machine, in the same stand, which delivers the corn from an inclined table, by means of a patented arrangement of endless chains, provided with fingers, which sweep off the cut corn and place it by the side of the machine. Messrs. Hornsby also exhibit an excellent thrashing machine, ploughs, and many other articles.

Messrs. Tuxford and Son show a 10-horse power patent "housed" engine, got up as usual with great care, an Appold centrifugal pump, saw-bench, &c., which call for no particular remark.

Messrs. Barrowes and Carmichael exhibit an 8-horse portable engine, one of the best of its kind, as far as neatness, simplicity, and good workmanship are concerned, that we have ever seen. The cylinder can be removed from the boiler with the greatest ease; all the bolts being accessible without removing the lagging. The crank is slotted out from the slab. The cross-head is peculiarly elegant in its construction. The position of the cylinder on the centre of the fire-box shell is objectionable, however, as it entails a very high crank-shaft. The engine is provided with steel volute carrying-springs — an arrangement which we trust will soon become more general.

Mr. F. H. Wenham exhibits the most remarkable engine within the walls of the Agricultural Hall. This little machine, weighing barely 2¼ tons, and scarcely larger than an ordinary 2½-horse portable, has indicated full 16-horse power. It is provided with a high and low pressure cylinder, placed one at each side of the chimney, on the haunches of the smoke-box. The smaller of the two is 5 in. in diameter, the larger 8¼ in.; the stroke of both being the same, 12 in. The cranks are placed at an angle of 90 deg.; steam is led direct from the boiler to the small cylinder, the exhaust steam from which is conveyed to a superheater in the smoke-box, the tubes of which are coincident with the boiler flues, so that both may be swept out at one operation. The steam dried and increased in volume, by a temporary sojourn here, is then led into the large cylinder, from which it finally escapes into the chimney. All the arrangements are simple and scientific, and we can very well credit the statement of the patentee, that he has obtained 16-horse power with about 32lbs. of coal per hour. Indeed, indicator diagrams, with which we have been favoured, leave no room for doubt as to the actual powers of a machine, which well deserves the favour of all employing portable engines. The small weight for a given power is in itself no slight advantage in a hilly or difficult country.

Mr. Collinson Hall exhibits a model of his ploughing apparatus; some illustrative drawings; and a steel link rope, constructed on his principle, which has ploughed over 600 acres of stiff land and looks none the worse. Mr. Hall eschews the wire rope, preferring one made of steel rods each about 18 in. long and half an inch in diameter, jointed to the next by two small, flat, steel links. The windlass employed is polygonal, and thus slipping is altogether avoided without any peculiar mechanical expedients. Mr. Hall's drawings illustrate a system of working by which the engine (or engines) rests stationary outside the field to be ploughed, two anchors being employed, between which the implement travels. The anchors are supported on small iron wheels, which proceed along the headland automatically, on rails, consisting simply of 2½-in. angle-iron bars of such a length that they can be conveniently moved by one man. The flanges support the anchor wheels, and prevent that important member of the system from yielding to the strain of the rope. The angle irons are retained in position by broad stakes driven into the soil, against which they bear. The anchor man takes up the bars as they are left behind, and, having previously driven the stakes, puts them down in position to receive the wheels as the anchor advances. We have, before now, spoken in terms of praise of Mr. Hall's system, which is we believe, really one of the best yet developed. Its economy is not its least recommendation; while its simplicity, and the ease with which the mechanism necessary, can be managed, and repairs effected, render it eminently suitable for situations where the aid of skilled labour is obtained with difficulty. Mr. Hall's apparatus is displayed in the stand of Messrs. E. R. and F. Turner, who exhibit a good 7-horse portable engine and thrashing machine; mills of various kinds; and Ager's patent digging machine—an ingenious implement, which is said to perform its work very satisfactorily.

Messrs. T. B. Brown, and Co., exhibit very excellent specimens of wire fencing, wrought-iron hurdles of various kinds, field gates, weighing machines, domestic flour mills, &c., for the manufacture of which the firm enjoys a high reputation. The entire display is very creditable.

Messrs. Wallis and Haslam exhibit a 4 ft. 6 in. combined thrashing machine, fitted with Coulson's spring hangers, and a hummeller resembling Underhill's elevator in its general details—the fan is not used as an elevator, however, its duties being confined to the hummelling of the grain, and the supply of a subsidiary blast for cleaning the corn. In this stand we noticed a very ingenious seam-presser and plough combined, which is well spoken of. This firm has lately purchased the patent for Lansley's single wheel steerage for drills, &c., which we recommend to the attention of agriculturists.

We had our attention called here to a well-finished model of Wallis's patent system of raising and delivering goods one, two, three, or four hundred feet, over intervening ground or buildings, without interference with the traffic beneath; thereby saving the whole of the expense of trucking or backing, as now in use. If goods are taken from a ship's hold, or from a railway truck, to the upper floor of a granary or mill, some power, by application of a strap to a rigger, is required; but for loading out, the apparatus is self-acting. The invention is partially carried out, and may be seen at work at Wallis and Thomas's flour mills, at Basingstoke, where the intervening space traversed is 160 ft., comprising a timber wharf, belonging to the London and South Western Railway Company, and a public footpath. The principle involved

is that of hauling the loaded sacks up an inclined wire rope.

Mr. Steevens exhibits a complete set of apparatus for cultivating land by steam power, and a four-furrow balance plough. We have already stated that novelties are few and far between in agricultural machinery just now. This plough is one of the few; and, unlike many other innovations, it is really good as well. It is not easy to describe the peculiar arrangements in which the merits of the instrument exist. As a whole, it resembles Fowler's plough in general appearance, but its construction is totally different. The main frame is fixed, while the two plough bodies, carrying four shares each, rise and fall beneath it, in such a manner that all the shares of each set enter or leave the ground at the same moment, and at the same velocity, in obedience to the hand of the ploughman. The steering apparatus is exceedingly simple—namely, a rack and pinion, turned by means of a wheel and a horizontal screw 2 ft. in length in a brass box, fixed in the centre, and geared by four bevel wheels. There are, also, two powerful rods at each end of the plough; which, when fixed in their proper position, keep it firm in its work, and prevent it from jumping, either on even or uneven surfaces, or up hill or down. There are no slades used with the mould boards, so that the draught is materially diminished, and the bottom of the furrow is unglazed. The plough is supported on four wheels, three on the land and one on the furrow side. The main wheels on which the principal part of the weight is borne, are 5 ft. 6 in. high, this large diameter giving lightness to the draught.

Messrs. Ransome and Sims exhibit an 8-horse portable engine, thrashing machine, ploughs, &c., and their patent rotary screen, which we know, by practical experience, to be one of the best, if not the best, of its kind.

In the stand of Messrs. Marshall and Son, we noticed an 8-horse portable, of very good design. The piston rod, slide bars, valve rod, &c., are of Bessemer steel, worked to a beautifully fine face. Everything about this engine is thoroughly well done—the oil cups, forged on the connecting rod head, &c.; the eccentric rods are dovetailed into the brasses, in addition to the usual bolts; all the nuts are case-hardened; and the fly-wheel balanced by coreing out the rim. Altogether. We regard this as a most favourable specimen of the agricultural engine, while the price (£225) is very moderate.

Messrs. Barrett, Exall, and Andrewes, have a good display of implements, the engines being peculiarly well finished. The stay bolts in the fire boxes of those shown are, however, rivetted over into countersinks, so that it is impossible to say how widely they are spaced by external examination. It is rather remarkable, that not a single engine shown is fitted with the injector; the use of a short-stroke plunger pump being universal. We presume that Mr. Giffard's invention is found to be too delicate in its action, and too whimsical in its temper, to be entrusted to the ordinary farm labourer.

Messrs. Brown and May, of Devizes, show a very neat 8-horse portable, with a steam belted cylinder. At Worcester, a similar engine, by this firm, gave a higher duty per lb. of coals, than any other commercial engine exhibited. In the same stand, is a little vertical 2½-horse engine, self-contained, which is a marvel of cheapness at least; the price being only £60.

We should neglect our duty did we omit to mention the Victoria self-raking reaper, exhibited by Messrs. Crosskill and one or two other firms. The machine is suitable for cutting any cereal crop, and delivering it at the side in neatly formed sheaves. The automatic delivery is very simple, and may be varied to suit any crop. It consists of a series of rakes and arms, which revolve round a vertical shaft under the guidance of an irregular waved ring or cam, in such a manner that they bring the corn forward to the knife, and subsequently deliver it, when cut, at the side of the machine.

The total number of stands in the Hall devoted to machinery is 126, from which we have selected all that was most worthy of note. The entire display is, on the whole, very creditable to the skill and energy of our agricultural engineers. Their designs generally show more taste and more forethought year by year; and the result is a mechanical fitness, so to speak, which adds both to the efficiency and durability of the class of machinery which they undertake to construct. As a class, they labour under disadvantages from which their professional brethren, following other pursuits, are exempt. Not only is their machinery severely tried by the exigences of situation; but it has commonly to go through the ordeal under the guidance of unskilful men, who scarcely possess the intellect or training necessary to qualify them for meeting emergencies after the best fashion.

The success with which the agricultural engineers of Great Britain have encountered difficulties and obstacles of no trifling importance, entitles them to a far higher rank than that which they hold. Too great a devotion to a struggle for mere commercial success, has hitherto operated disadvantageously; while the system of turning out "racers," encouraged by an erroneous method of awarding prizes at agricultural shows, has done anything but tend to raise the social status of the class, in the estimation of the scientific world. Matters are much better in this respect than they used to be; and a very few years of progress will, we trust, banish remaining abuses, and place all the operations of the agricultural engineer in a proper aspect, both as regards himself, and the world at large.

THE EXTENSION OF STEAM TILLAGE.

THE agricultural engineering fraternity appears to carry out as vigorous a propaganda as that of the disciples of St. Ignatius de Loyola. Their missionaries are sent out to convert the farmers of every civilized country. Like other prophets, their powers of conversion appear to increase in the direct ratio to the distance of the field of their exertions from their native country. The foreign missions seems to have the most success, and the benighted lands of Russia and Egypt appear to be more receptive of agricultural truth than the United Kingdom of Great Britain and Ireland. Last Wednesday afternoon, however, a meeting was held at St. James's Hall, for the special conversion of the British farmer to the doctrines of steam tillage.

Taking advantage of the great concourse of agriculturalists from all parts of the country to the Smithfield Club Show, the General Steam Cultivation Company were thus enabled to expound their intended course of action before a befitting audience. Though not very numerously attended, the meeting could well be called select, as the gentlemen present were evidently all more or less practically interested in the question of steam ploughing—speakers of all ranks, from the Earl of Suffolk, to small tenant farmers—agriculturists from Australia and the West India dependencies—alternately gave their opinions to the meeting, or made inquiries of the more experienced users of the steam plough. The intended operations of the "General Cultivation Company," are substantially those of a Loan Company. It proposes to furnish owners and farmers of land with all kinds of steam machinery, the price of which is to be repaid to the company in annual rates extending over periods varying from three to seven years; one-fourth of the price of the machinery being paid down by the purchaser within three months of the date of the agreement. The last amount would evidently be covered, in most cases, by the sale of the horses and horse implements, superseded by the steam machinery. But as a farmer, name unknown, very sensibly pointed out, even this outlay could not be incurred by the small tenants of, say, 50 acres. He advised the company to sell machinery in the way proposed to the now numerous class of hirers out of steam-thrashing machinery; and the company would, no doubt, find it to their advantage to adopt this plan.

It is to be hoped that the company will be in every way successful, and numerous similar bodies will then at once spring up in all parts of England. Nothing else is needed to make steam ploughing as general as steam thrashing. Even if we had not had some practical experience in the matter, the facts and figures cited at this meeting—by Mr. Holland; by Mr. S. Hutchkinson, the author of a noted essay on steam cultivation;* by Mr. Williams, of Abingdon; the Earl of Suffolk; Sir George Jenkinson; and by others, more especially by Dr. Vœlker—would be sufficient to convert us, as well as the most sceptical and conservative agriculturist. One gentleman alone seemed still undecided. "A Suffolk land-owner, he had undergone in 1853, dire and dearly-bought experiences with a thrashing machine and engine. This engine was worked out in a few months, and his thrashing machine would scarcely work at all." Has not this gentleman eyes to see and ears to hear, now in this year of grace, 1863, the universally used thrashing machine? Does it not occur to him that his engine and thrasher must have been mismanaged; that his unpractised farm labourers probably burnt out the fire-box by letting the water get low, and were unable to arrange the intricate riddles and screens of his 1853 thrashing machine? Can we conceive of a man getting up ten years hence, when steam ploughs will be as much in use as thrashing machines now are, and complaining that his ploughing engine and tackle got out of order from want of attention? The experience of this gentleman is an instance of one of the difficulties to be encountered in the introduction of machinery. Lord Robert Montague's experience, as related by himself to the meeting, is another instance, but of a different kind—that of foregone prejudice. "Until he had lately seen one of Fowler's ploughs 'racing' over a field, he did not believe steam cultivation to be more than a visionary scheme." Such is the fate of everything new in engineering. Something visible, and palpable, and successful must be placed before the unthinking multitnde of all classes—anything less tangible is prejudged to be impossible.

Several resolutions were carried *nem. con.* at the meeting. We fully agree in those

* "Fire and Water *versus* Corn and Hay:" an Essay on the Effects of Steam Cultivation," by SIMON HUTCHKINSON, Third Edition. Fourth Thousand. London: Simpkin Marshall and Co., 1863.

bearing upon the intended mode of procedure of the company. The first resolution has been endorsed by every user of Fowler's steam tackle—"That the cultivation of the land by steam is now proved to be an advantageous and highly economical process; and that the machinery now used for this purpose is of a character sufficiently perfect to be recommended for the use of practical farmers." The substitution of an untiring, ever-working, coal-fed apparatus, consuming its food when at work only, for a costly corn-and-hay-fed fragile, ravenous, flesh-and-blood animal; the use of an implement working with such speed as to render the agriculturist independent of the seasons; the possibility of attaining a tilth so deep as to increase the produce by one-fourth; the improvement of the land by the complete burying of the weeds; the avoidance of the "pan" always caused by the treading of a team of horses and men, never weighing less than two tons; are not the only advantages—great as they are—of the steam plough. Mr. Williams, a practical farmer, and Dr. Voelker, both in their different ways, pointed to the great saving in costly manure effected by a deep tilth in clay land. The strong clay lands of England can now be worked at as little cost as light land by horses. It is often superficially remarked, that light land cannot be more profitably worked by steam power than by horses. It is the case, that the cost of ploughing per acre is not less on light land with steam. But the work can be done with greater speed on light land, from there being little strain on the rope, and from a larger plough being applicable. As was well observed by Lord Robert Montague, no earthly power can increase the area of the country in the ratio of the increase of population; but the cubic contents and productive power of the land under cultivation, is to be increased by a deeper tilth than can be obtained by animal force; and by means of railway communication, the coal to be substituted for the corn and hay required to develop animal power, is now brought to every English farmer's door.

Our opinion of the practical value of Fowler's tackle is even higher than is expressed in the resolution we have quoted. Not merely is "the machinery sufficiently perfect to be recommended for the use of practical farmers," but we say that, humanly speaking, Fowler's tackle is not to be improved. The construction cannot be much cheapened. It is of no use to wait. It is of no use to expect anything better. Steam tillage is no longer "in its infancy." Steam ploughing was attempted 250 years ago; Wildgosse, of the 17th, preceded Fowler of the 19th century. The only plans at all successful, were those of Heathcoat and of the Marquis of Tweeddale, and they both used contrivances similar to those of Fowler; but they lacked Mr. Fowler's perseverance, and were less aided by the mechanical powers of the present time. Romaine's rotary digger was freely tried, and as completely found wanting. Nearly a quarter of the power was consumed in merely carrying rotary diggers over their work. Halkett's plan of carrying about a ponderous bridge-platform and engine will never supersede the steel-wire rope. Boydell's elephantine engine will never again be seen dragging half a dozen hand-ploughs at its tail.

Of course we do not suppose that the doctrine of the finality of reform can ever be accepted in an engineer's workshop. Many of the details will, doubtless, be improved. The engine may be simplified; it may be made to consume less fuel. Much power is consumed by the clipping pieces of the hauling drum: it is evident that the tackle itself can be only improved in two directions; by diminishing the waste of power due to the bending and friction of the rope, if it be possible, or by improving the form of the tilling implements. Some highly valuable dynamometric experiments made by Messrs. Morton and Harrison have determined the furthest tether to which these improvements may be carried. From the published account of these experiments we extract the following details:—A four-furrow plough, cutting 8 in. deep at a speed of three miles an hour, was found to exert a total strain of 36 cwt. on the 700 yards long rope, which was stretched between an engine and anchor 350 yards apart. The slack rope was found to be strained up to 7½ cwt.; and, subtracting these 7½ cwt.—equally exerted on both sides of the clip drum—from the total strain of 36 cwt., 28½ cwt. remain due to the total draught. Mr. Morton found that no less than 95 per cent. of the total draught was applied to dragging the implement; only about 1½ cwt. being consumed in the draught, &c., of the rope, and in moving the anchorage. The draught of the plough, when out of work, was found to be 2¾ cwt.; leaving 24¼ cwt. or 86 per cent. of the total draught to be employed in turning the furrows. We do not suppose that any other arrangement could be made to consume much less power. And yet an able speaker, at the meeting, complained that the ploughing apparatus was not light enough nor cheap enough, and that it consumed too much power. This gentleman came from Antigua, and he stated that he had seen Fowler's steam plough effecting wonders in the island of Barbadoes, and at Demerara. At Barbadoes, they were ploughing 12 in. deep with a Fowler's tackle, and the effects upon the sugar crop he stated to be wonderful. At Demerara, the engines were placed on the canals, in punts, and much difficulty was experienced from the rope cutting into the banks of the canal. This gentleman's expectations seemed to be greatly raised by a paragraph in the *Times*, to the effect that the French Emperor had given an order, in Paris, for a dozen steam ploughs, of a marvellously light and cheap structure. This intelligent colonist seemed to be as yet unaware of the immense distance between the truth of a paragraph in the *Times* and a mechanical improvement. Another gentleman, who said that "he had the misfortune to be an Irishman and an Irish landlord," stated that he expected to see the salvation of Ireland through the steam plough; that it would remedy the depopulation of the country through the everflowing exodus to America, and that the peasants remaining in the country would be much raised from their present status by the facilitated cultivation of the soil.

We wish every success to the undertakings of the General Steam Cultivation Company.

THE ORDNANCE REPORT, 1863, CONDENSED; AND CONCLUSIONS FROM IT.

No. V.

THE ARMSTRONG SYSTEM.

GOING back to 1854, when Mr. Armstrong first presented himself to the Government in the character of an artillerist, and carefully tracing his proceedings since that period, the Select Committee on Ordnance came to the conclusion that Mr. Armstrong was to be regarded as the projector of a system of artillery. After receiving impartially the voluminous evidence brought before them for the purpose of determining the nature of the Armstrong system, the Committee represent in their report:—1. "That Mr. Armstrong proposed a method of constructing a gun which rendered it capable of enduring the strain to which rifled ordnance is submitted; 2, that Mr. Armstrong introduced to the notice of the Government a plan of breech-loading; 3, that he adopted the old polygroove system of rifling, which involved the coating of the projectile with soft metal."

The Committee, it must be admitted, exercised a sound discretion in defining the "system" in these general and cautious terms. They are the precise words of the Report. They state the heads under which the combination of construction, which "came to be viewed as the Armstrong system," is to be considered.

That it may not be supposed we are influenced by any bias against the system, we will let the witnesses, including Sir William Armstrong himself, speak on the points above stated, before we offer any comment.

The Report informs us that, in the construction of the Armstrong gun, the principal feature which renders it capable of resisting the strain to which rifled ordnance is submitted, is the application of the coil system. It has been inferred, but nowhere stated in the evidence, that Mr. Armstrong had in laying his plans before the Government claimed that method of strengthening guns as his invention. However that may be, the following testimony affords abundant proof that there is no foundation for such a claim:—

Mr. Whitworth (No. 1,204 to 1,213): "The coil principle is not Sir W. Armstrong's invention; he was not the first inventor. Many years before him, patents were taken out for the coil principle. I used the coils in 1855. The barrels of fowling-pieces are coiled. As far as the tube is concerned, it is made in the same way as the old fowling-piece barrels."

Mr. W. W. Hulse (No. 1,286): "In 1855, I made hoops of welded coiled iron." (No. 1,358): "The hoops were made by simply twisting a bar of iron, in a heated state, around a stud or pin placed in in the centre of the smithy, and then forming a coil, and afterwards getting it up to welding heat and hammering it into a coil or hoop; that was Mr. Bamforth's plan." (No. 1,359): "In the small model gun (produced before the Committee), there were instituted three experiments with a view to ascertain the best mode of constructing the hoops, so as to give the greatest strength, with the same quantity of metal. One mode was that of welding the hoops together diagonally, as a band of iron; the second mode was taking a riband of iron, and folding it round, and welding the ends to the body; the third plan was taking the band of iron, coiling it round spirally, and welding it endwise; then the hoops were subjected to inside pressure, so as to ascertain which would yield first; and the spirally made hoop stood the greatest pressure." (No. 1,360): "Was that model (referring to a small gun produced by the witness) constructed of hoops made from coils made from a riband of iron on the same principle as Sir William Armstrong's are now made at Woolwich?"—"Yes, precisely." (No. 1,363 to 1,367): "Were the hoops made for the gun?"—"Yes." "How were they made?"—"Variously; those made by Mr. Bamforth were made as explained by Mr. Whitworth, coiled spirally, for I went to Mr. Bamforth myself from Mr. Whitworth, gave directions myself, and conferred with him on the best plan for carrying them out."

Mr. Vivian: "That was in 1855?"—"Yes."

Mr. Baring: "Therefore those hoops were made, not by Mr. Whitworth, but under his directions, on precisely the same principle and system as the hoops made at Woolwich?"—"They produced precisely the same results, but they were not made by precisely the same means."

"Will you explain the difference to which you point to the Committee?"—"The difference in means was, that at Woolwich they had a furnace 90 ft. long, which we could not obtain in any manufactory then existing; they had coiling apparatus and steam hammers purposely adapted to the work; they had a large plant established, which could not be had by us." (No. 1,369): "No large guns were ever made without coiled hoops by Mr. Whitworth; nothing above 12-pounders." (No. 1,370): "Those coiled hoops, I suppose, being not only iron made into a coil, but on precisely the same principle as the Armstrong coil?"—"On precisely the same principle as the Armstrong coil, only that the hoops were never welded to each other; the hoops made at Woolwich are turned and recessed, put into an hydraulic press, and then put into a furnace and welded together; that plan was never adopted by Mr. Whitworth." (No. 1,371 to 1,381): "There was a limit to the length of the hoop in our establishment, which was not experienced at Woolwich." "If they made two hoops at Woolwich of a given length, they could afterwards, with their facilities, weld them together so as to make one continuous length, dovetailing them together. The small hoop, made under Mr. Whitworth's directions, was made of a coil, forged endwise and welded. It was constructed of a bar of iron twisted round and round, so as to make it spiral, and it was welded endwise." (No. 1,362): "The hoops in Sir W. Armstrong's guns were connected longitudinally—they were welded together. Mr. Whitworth prefers to connect them together by a screw."

Mr. Whitworth (No. 1,311): "The difference between Sir W. Armstrong's gun and mine, in respect of coiled iron, is, that I have always used an inner tube, which has always been made from a solid bar not coiled. Sir W. Armstrong has used an inner tube of coiled iron, as well as the hoops." (No. 1,312): "Sir W. Armstrong, in a letter, stated, that when he did make the gun with an inner tube, made out of a solid forging instead of from coiled iron, he did not approve of it." (No. 1,316, 1,317): "I have never yet made a gun with a tube of welded iron; I never would think of doing so; I prefer a mild steel, or what is called homogeneous iron." (No. 1,318): "The Armstrong guns are entirely composed of coiled iron welded. The inner as well as the outer hoops are welded coiled iron." (No. 1,320): "There is nothing new in the system of coiling iron to make guns—that has been practised for many years with the outer hoops." (No. 1,322): "There is no novelty in getting the requisite strength for a gun by using coiled iron; it is quite old." Captain Blakeley (No. 4,627): "Is your system of coiling the same, or does it resemble that of Sir W. Armstrong?" "I cannot see any difference. The manager of the Butterley Company, in Derbyshire, which made my guns in 1855, who accompanied me to the Woolwich Arsenal last year, or the year before last, said in my presence that the system on which they were making the guns there, was identically the system on which they had made guns for me in 1855." (No. 4,642): "Therefore, at that time, your idea would be that the external portion of the gun should be made of coils and the inner tube of steel?" "Yes, exactly so; and that is what Sir William Armstrong's gun is now." (No. 4,645): "The real essence of Sir W. Armstrong's gun and of my gun does not lie in the use of those coils, but in the manner in which the outer coils are made to compress the inner ones, so as to make the two layers act in unison in resisting the strain. This is very clearly explained by Sir W. Armstrong in his letter, of the 14th July, 1855, in the Blue Book of last year."

We have given the evidence relating to the coil system at some length, that the principles of construction involved in it may be understood. Notwithstanding the concurrent testimony of competent and trustworthy witnesses, Sir W. Armstrong, without venturing to maintain that he is the inventor of the coil system, which would be a manifest absurdity, lays claim to originality of design in the mode of constructing the coils. As the fairest way of testing the validity of this claim, we will let Sir W. Armstrong speak for himself. In answer to the Chairman's question (No. 3,163), Sir W. Armstrong says, "I should wish to run through a brief history of the whole of the transactions, with respect to my system of rifled ordnance, so that the Committee may have before them the entire case, in a compact form." He then makes a detailed statement of his views for constructing rifled guns of the required strength and of the measures he took to carry these views into effect. With reference to the coil system, the following are his observations:—"The substitution of elongated solid projectiles for spherical bullets, is an essential step in the attainment of very extended range in artillery practice; but the lengthening of a solid projectile involves the necessity of strengthening the gun, to enable it to resist the greater intensity of force, which becomes necessary to give the required velocity, and this object can only be effected, consistently with lightness, by constructing the gun of steel or wrought iron, instead of cast iron or bronze." "There is also much uncertainty in the lateral strength of wrought iron or steel, because the flaws or imperfections of welding, which exist in all thick masses of those materials, almost invariably run in the direction of the length, and in general, therefore, only detract from the strength in the transverse direction. It is for these reasons that the barrels of muskets and sporting guns are formed by twisting long slips of iron into spiral tubes, and then welding together the edges, by which means the longitudinal length of the slips becomes opposed to the explosive force of the powder, and the weldings being transverse with the bore have no important influence in lessening the strength of the barrel."

Sir W. Armstrong, after referring to the failure of his attempts to make gun barrels of sufficient strength by forging wrought iron into the usual form, states—"The results obtained in this manner showed, as had been apprehended, great uncertainty in the strength of the material, and rendered it impossible to define the thickness necessary to resist a given charge of powder. I felt compelled, therefore, to dismiss this mode of construction, and to adopt another, more correct in principle, but more difficult of execution."

He next describes his plan of making an inner barrel of steel, and continues—"The parts surrounding the steel centre consist of twisted cylinders of wrought iron, made in a similar manner to gun barrels, and, being shrunk upon the steel, they are in that state of initial tension which is necessary to bring their entire strength into operation." The gun is described as having a steel barrel, and the external parts are represented as coil. The mode of breech-loading is also described—"That was the first gun delivered in 1855, which was accompanied by the Report, from which I am quoting this description and these drawings, therefore, furnish a complete definition of what the gun really was. It was a gun with a steel tube, surrounded with coiled cylinders similar in every respect to the tubes of gun barrels. Now the peculiarity of that gun was not its being merely a built-up gun, because built-up guns are of very ancient date. In fact, I have no doubt that the original construction of all guns was by building-up. It was not merely a hooped gun, that is to say, a gun strengthened by rings, because rings give only circumferential strength, and no longitudinal strength; but that gun was peculiar in being mainly composed of tubes, or pipes, or cylinders, formed by coiling spirally, long bars of iron into tubes, and welding them upon the edges, as is done in gun barrels. Now, whether any one had conceived that idea before is beyond my power to say; but I feel assured that no gun, up to that time, had been actually made upon that principle. The whole difficulty lay in the making. It is very easy now, with all our knowledge and experience, to define how such coils are to be made; but at that period it was a very difficult matter to accomplish, and it was not until I had made very many unsuccessful attempts that I succeeded in satisfactorily carrying it out."

We here have from Sir W. Armstrong a detailed description of the effect of forming tubes with slips or bands of iron, spirally coiled and welded, in increasing the strength of the barrel; but that effect was well known to gunmakers long before Sir W. Armstrong's time. At the period (1854, 1855, and previously) when the attention of artillerists was first drawn to the value of rifled ordnance, Mr. Armstrong was not the only or the first person who perceived the importance of applying the spiral coil principle—long before in general use for small arms—to great guns. In taking credit to himself for this adaptation of a well-known principle, he assumes a merit to which he has not the smallest claim—not even that of priority of adaptation. In his diffuse statement, of which we have only given some extracts, he argues his own case with no small amount of self-sufficiency—as if all the artillery world but himself had been standing still. This notion, which seems to be a fixed delusion in his mind, and for some time infected the War Department, is completely dispelled by the evidence in the Report, proving that the minds of other persons, as capable and more practical than Sir W. Armstrong, were at work on the same ideas, not only simultaneously, but prior to his first experiments. The real difference between him and them was, as we have proved from the Report, that he had the patronage of the Government, and they had not. If the opportunity, freely accorded to Mr. Armstrong in 1854 and 1855, of making experimental guns for the Government, had been afforded to the Mersey Steel and Iron Company, Mr. Whitworth, Captain Blakeley, and others, they too would have manufactured trial guns for the War-office on the coil system. By this competition of mechanical talent, properly encouraged by the public authorities, some of the blunders into which they, under the guidance of Sir W. Armstrong, have fallen, would have been foreseen and avoided, and the country would have obtained a far more effective system of rifled artillery than it now possesses.

(To be continued.)

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

On the night of Saturday, the 5th inst., the ordinary monthly meeting of the above Society took place. Mr. J. Newton, of the Mint, filled the chair, and the attendance of members was numerous. It had been arranged that Mr. Stanley should read a Paper on a "Substitute for the Slide Link Motion;" but, although that gentleman had prepared his Paper, as well as models and diagrams to illustrate it, he was too seriously indisposed to attempt the arduous task, and the reading was postponed. Many new members, however, were elected, and the Chairman subsequently directed, in a few feeling remarks, the attention of the Society to the painful circumstances which had attended the death of the well-known author of many mechanical and scientific works, William Templeton. It was needless, he said, for him to expatiate upon the claims which Templeton had upon the mechanical communities of this and other countries. His books were text-books; and his scientific memoranda, guides to all *young* mechanics especially. Templeton, however, had died in extreme poverty. The booksellers had reaped the fruits of his labour, and his widow inherited honour,—and destitution. As Templeton had been an honorary member of that Association, Mr. Newton thought that a small sum—they could not afford a large one—should be voted from their funds for the benefit of the widow, and that in addition a voluntary subscription should be opened up in her behalf. It might not be improper to furnish some brief notes in reference to the life of William Templeton; and possibly if the scientific press—ever ready to assist in such cases—were to give them publicity, attention would be drawn to the matter of the widow's destitution beyond the walls of that room. Mr. Templeton was born at Caltrine, Ayrshire, on the 9th of February, 1796. He was the father of a large family—namely, seven sons and three daughters—of these, six of the sons were unfortunately dead. Templeton was for some time a Chief Engineer in the Royal Navy—in fact, for five years. He left the service, however, and, for one year subsequently, was located in the Island of Java. Failing health compelled him to leave that place, and he next went to Australia. While there, Templeton superintended the erection of a breakwater at Port Elliot, and wrote a small work, known under the title of the "Commercial Prompter." On returning from Australia, he devoted himself to scientific literature. His principal works are the "Millwright and Engineer's Pocket Companion," "The Steam Engine Popularly Explained," "Mathematical Tables," "The Workshop Companion," "Practical Examinator," "The Engineer's, Millwright's, and Machinist's Practical Assistant," and others of a like character. The poor author died in London on the 12th of August last, aged and destitute.—At the conclusion of these remarks, Mr. Blackett explained the circumstances attending the last hours of Mr. Templeton, and confirmed the Chairman's statement as to the sad condition of his widow.—On the motion of Mr. Ross, it was agreed to devote the sum of £5 from the funds of the Association for the relief of that lady, and, at the same time, to open a subscription list in her behalf.—Finally, a committee was nominated to receive contributions to that end. The committee comprise:—Mr. William Ross, Messrs. Rennie's, Holland-street, Blackfriars; Mr. John Ives, Messrs. Henry Grissell and Co., Regent's Canal Iron Works; and Mr. Sanson, of 20, Cannon-street, City, either of which gentlemen will be happy to receive any sums, large or small, in trust for the widow Templeton.—It is to be hoped that throughout the country there will be a generous response to the appeals of the Committe of the Association of Foremen Engineers of London.

The Adriatic Mills in Worcester, Mass., are driven by a Corliss engine, which has a belt on it 30 in. wide, 114 ft. long, and double throughout.

MACKILLOP'S SYSTEM OF CLEANING SHIPS' BOTTOMS.

Fig. 1.

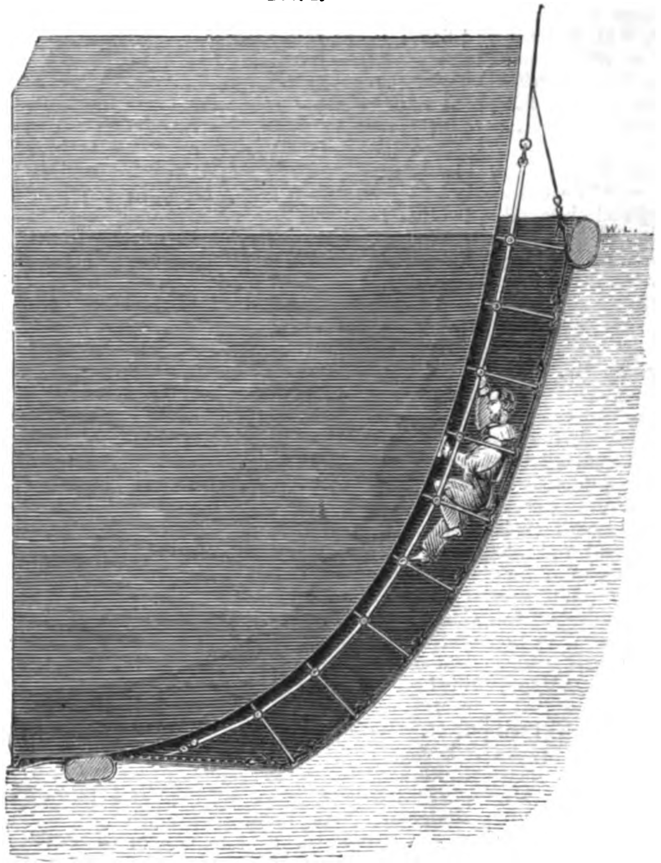
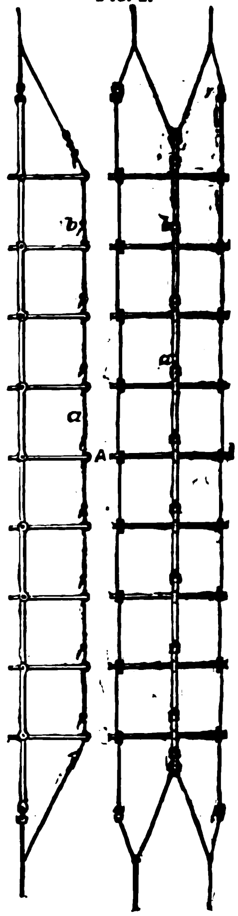


Fig. 2.

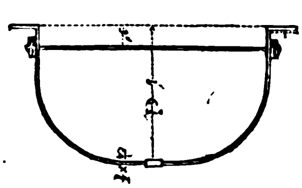


MACKILLOP'S SYSTEM OF CLEANING SHIPS' BOTTOMS.

The machine is made of canvas and india rubber or leather. The portions A, in the accompanying engraving, are air-tight, and inflated after the machine is submerged and placed under the ship in the desired position. An iron ladder with arched back pieces, fig. 2, B, is lowered over the ship's side with a guide rope under the keel, brought up on the opposite side, over which the flexible machine is placed and inflated. Should a coffer-dam be wanted, the air cylinders A and A, on either side of the ladder, will by the pressure of the air adhere close to the bottom and side of the ship, and admit of the water being pumped out of the dam thus formed in the centre of the canvas machine.

Should the machine be simply wanted for re-

Fig. 3.



moving grass and incrustations from the bottom, the ladder is left out, and the lining of the machine brought close to the ship's side, between which unslaked lime and other substances are introduced from the water's edge, the action of which, in the process of slaking, will destroy animal and vegetable life. When this has been done, the machine must be moved along the bottom by the guide and keel ropes, which will remove at the same time all the foul matter previously acted upon by the lime. This process may be repeated along the whole length of the ship, after which the ladder may be put in position and portions of the bottom examined.

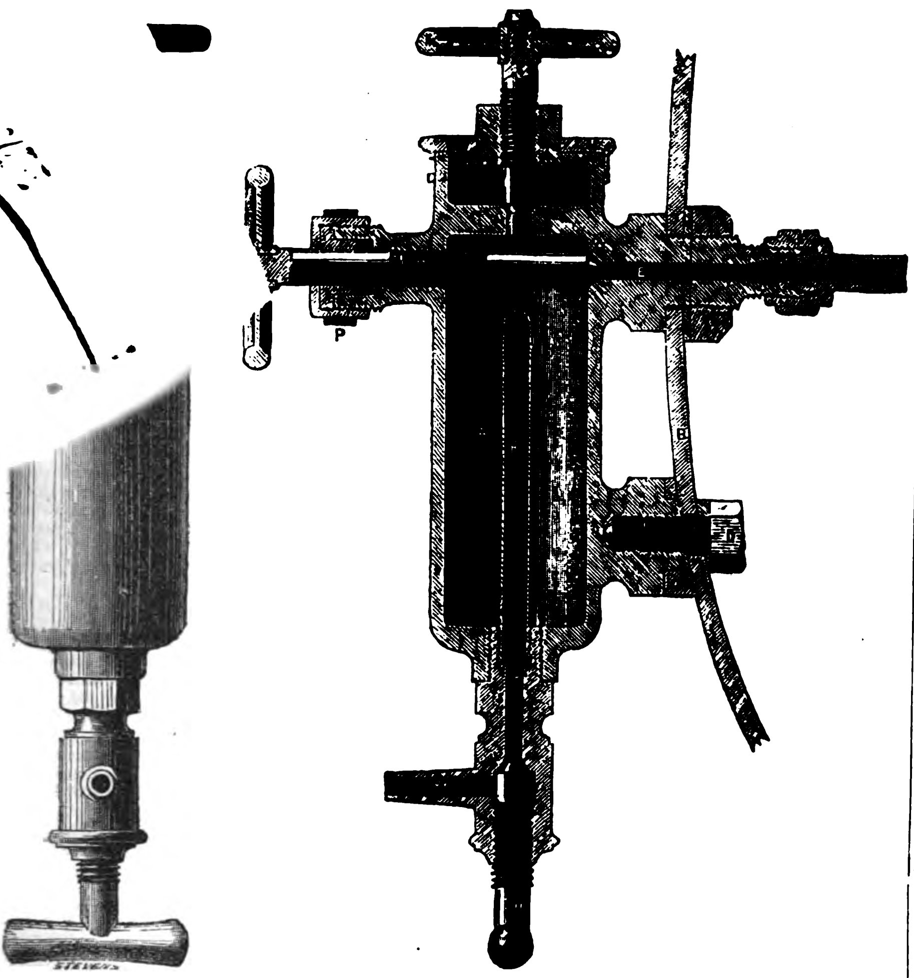
Should a ship at any time, having one of these machines on board, spring a leak, the machine may be quickly and easily placed over the leak and inflated, when the adhesion will not only be sufficiently secure to stop the leak, but it will allow of the ship making the remainder of her passage with very little detriment to her speed. The machine, when inflated on the water, may be used as a pontoon or raft by laying a few planks across it, when it will carry from 30 to 200 men, according to the class of ship it may belong to.

The Lords of the Admiralty are now having two of these machines prepared at Chatham, under the immediate superintendence of Captain Mackillop.

ROSCOE'S LUBRICATOR, FOR STEAM ENGINES.

This self-acting lubricator has been designed and constructed more especially to prevent the great friction on the slide valves and cylinders of locomotive, marine, stationary, colliery, mining, agricultural, and all other steam engines and steam machines. When the engines are at work, by its continuous action it constantly delivers minute qualities of lubricating matter, to the cylinders and valve faces; whereas, the lubricating cocks generally in use, deliver their contents in a few seconds, and the tallow, oil, or other lubricating matter let in, is necessarily blown away rapidly, and the valves, valve faces, and cylinders are left to work dry after a few strokes. This lubricator, when in use upon locomotive engines, does away entirely with the present dangerous practice of walking on the side of the engine to fill the lubricating cocks, when the train is travelling at a great speed. The lubricators were not designed to save lubricating matter; but wherever used, the engines are found to require considerably less than with the ordinary cocks.

ROSCOE'S LUBRICATOR FOR STEAM ENGINES.

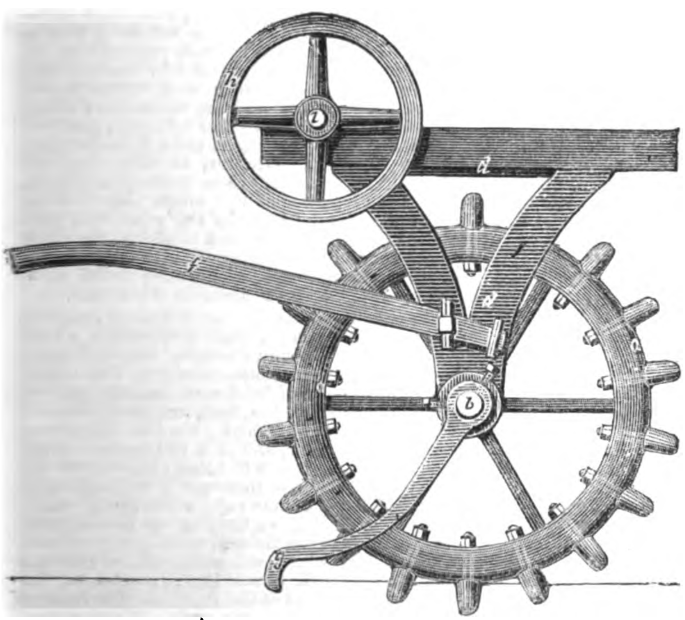


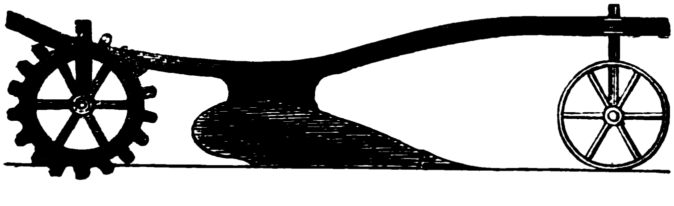
In the accompanying engravings, A is a vessel containing the tallow, oil, or other lubricating matter, and is made of any convenient form and size; but the shape shown in the accompanying drawings is the one usually preferred. When applied to locomotives, it is attached to the smoke-box B by the nut C and the screw D. E is a horizontal tube, cast to the vessel A, and attached by the union F to the pipe G, which communicates with the steam-pipe or chest. H is the cover of the vessel A, and communicates, by a groove, cut through its upper surface, with the hole or slot I, through the collar K, which carries the screw valve L, which is worked by the wheel M, and rests in the valve seat N. O is a regulator-valve, which passes through the stuffing-box P, and rests in the valve-seat Q. R is an air-tube, fixed in the waste-cock S, and communicates by the pipe T with the screw valve U, which rests in the valve-seat V, and communicates externally by the tube W. To put the instrument in action the regulator valve O is shut, and the screw valve U opened, to allow the waste water to escape by the tube W; it is then closed and the cover H turned until the groove communicates with the hole or slot I, the screw-valve L is then opened and the lubricating matter poured into the vessel A; when filled to the level of the tube E, the valve L is closed, and the regulator valve O opened, which allows a portion of steam to enter the vessel A, where it is immediately condensed, and by its gravity descends to the bottom of the vessel, thus displacing a minute portion of the lubricating matter which passes through the tube E and the pipe G into the steam-pipe or chest, and from thence into the cylinders, which are, by the continuous action of the lubricator, kept constantly lubricated, as also the slide valves, valve spindles, piston rods, and all the frictional parts wherewith the steam comes in contact.

When the steam is first let in, it compresses the air in the air-tube R, and the continual alternate expansion and contraction of the air by the action of the steam, keeps up a constant agitation, and with locomotive engines when going down inclines with the steam shut off, the expansion of the compressed air forces out a quantity of lubricating matter into the steam-pipe or chest, which keeps the cylinders, &c., effectually lubricated, until the steam is again let in. The regulator valve O is set to use any required quantity of lubricating matter according to the size of, or speed of an engine—for instance, to use the same quantity with a locomotive engine in 100 miles with a slow train would require the regulator valve to be shut closer than it would for a fast train running the same distance, and it can be as easily regulated to use 1 oz. as 16 oz. of lubricating matter in a given time.

When applied to fixed engines, the lubricators should be placed in as cool a position as possible, on account of the condensation; and in all cases the pipe G (which for fixed engines should not be less than 3 ft. in length) requires a slight descent from the lubricator to where it enters the steam pipe or chest. When in action, the principle upon which this lubricator is constructed prevents the possibility of the water or lubricating matter in the apparatus freezing, even in the coldest climates. The lubricators are made by E. H. Newby, Leicester.

MACHINERY FOR PREPARING LAND FOR SEED.





KING AND MARSHALL'S IMPROVEMENTS IN MACHINERY FOR PREPARING LAND FOR SEED.

THIS invention, patented by Messrs. John King and Henry Marshall, of Warwick, has for its object improvements in machinery and apparatus for preparing land for seed and for harrowing land. In constructing machinery and apparatus for dibbling land, wheels are used with dibbles set on the peripheries, such dibbles are arranged to be adjusted nearer to or further from each other, according to the distance apart at which it is desired to insert seed, and they are also each arranged in such manner as to have a movement when in the land in order to free them therefrom without breaking up and injuring the sides of the holes formed by them. It is preferred that a pair of such wheels should be mounted on the same axle in such manner that they may be readily adjusted to and from each other according to the distance apart it is desired to have the rows. The axle carrying the dibble wheels turns in bearings in a suitable frame; this frame at its centre is capable of turning on a short vertical axis carried on the under side of a frame that is provided with shafts, the frame carrying the dibble wheels is provided with two handles or levers by which this frame can be inclined to the shafts, and the dibbles be thus steered or guided. The shaft upon which the dibble wheels turn is provided at each end with a rod which descends downwards, and the lower ends of these rods, when the machine is at work, enter a short distance into the land, and thus as the machine moves along make lines along the ground; the machine can thus be readily guided by causing the rod on one side of the machine to be moved along the line previously made by the rod

on the other side of the machine. In order that the machine may be drawn along a road or other surface without the dibbles coming in contact with such road or surface, the frame which is provided with shafts carries an axle on its upper sides, which axle is provided with two road wheels; these wheels are of such a diameter that they shall be above the land when the dibble wheels are resting on it; these wheels can, however, be brought on to the land by turning over the shaft frame by means of the shafts, the dibble wheels will then be lifted off the land, as the rod upon which they turn will, by the frame having been turned over, be brought above the axle of the road wheels in place of being below it. In some cases a dibble wheel, such as is above described, is combined with a plough in such manner that the dibbles may run along the ridge or portion turned over by the plough, and prepare the same for receiving seed in the holes formed by the dibbles. In order to harrow land, whether before or after sowing the seed, the patentees construct a harrow of numerous similar parts, each part carrying a tine or tooth, and each of such parts is formed to be connected to two similar parts in such manner that when pressed together they form what may be said to be a rigid bar consisting of several parts; when the harrow is on the land, and the teeth penetrating it, the several parts will be drawn out to a certain extent, by which the parts which carry a row of tines will become flexible, and allow each tine to rise or fall independently of the other tines in the same row. For this purpose the ends of the parts are connected by pin joints, and one end of each piece is made with a slot through it through which the connecting pin passes, and the ends of these pieces are formed to lock into each other when pressed together. At the angles the pieces are formed in the shape of right-angle bends.

Fig. 1, in the engraving, shows a side elevation of a dibbling machine constructed and combined according to this invention.

a, *a*, are two dibbling wheels, in the peripheries or outer rings of which are slots through which the stems of the dibbles pass, and are by screw nuts fixed to the outer rings of the wheels at such distances apart as may be required for the particular crop. The dibble wheels are capable of turning freely on a fixed axle *b*, and they are set to or from each other by means of collars between which they turn; these collars are capable of being slided to and fro on the fixed axle, and of being fixed thereon in any position by set screws, by which the width between the rows of holes made by the dibbles may be adjusted from time to time as may be required. The dibbles are shown to be fixed to the wheels; but this may be varied, and provision made for giving each dibble a rotary motion when in the land, as has before been done. The axle *b*, on which the dibble wheels are mounted and turn, is fixed in a frame *d*, which turns on a short vertical axis *e*; and such frame with the dibble wheels is guided by handles *f*, *f*. To the ends of the axle *b* are fixed rods *g*, *g*, which descend into the land and make marks, so that in returning one of the rods *g* is caused to follow the mark made by the other rod *g* in the previous bout. In order that the machine may, when out of use, be moved along ordinary roads, a pair of wheels *h*, *h*, and axle *i*, are applied at the upper surface of the frame at the back ends of the shafts, and they are brought into use by turning the machine over.

Fig. 2 shows a dibble wheel combined with a plough in such manner that the dibble wheel may act on the ridge as it is formed by the turning over of the land by the plough.

POWER OF WIND AS APPLIED TO FLOUR MILLS.

The application of that violent and intractable element of nature, the wind, to impel machinery, displayed no little boldness on the part of our early mechanics. Windmills are supposed to have had their origin in Germany, about the middle, or towards the end of the 11th century.

It has been often asserted that windmills were first invented in the East, and introduced into Europe by the "Crusaders;" but this is very improbable, as mills of this kind are seldom or never found in the East. There are none of them in Persia, Palestine, or Arabia, and the writer has seen only one in India, which was recently erected. There are several windmills around the town of Smyrna, in Asiatic Turkey, and also on the banks of the Hellespont, in Asia Minor; but it is believed that they were erected subsequent to examples having been presented to them from Europe.

About forty years ago, when the soil of Great Britain was imperfectly drained, the soil was the grand reservoir for storing up the rainfalls and maintaining the uniformity of flow in our water runs; but since the introduction of arterial drainage, our rainfalls are transmitted direct to the sea; and at the present time the mean flow of water in our mill leads is reduced to about 50 per cent. of what it was forty years ago; and it becomes a question whether the application of wind power might not be extended with advantage for the driving of all kinds of grinding mills, also for that of saw mills; reserving our water falls and steam power for purposes requiring a constant and regular supply of power, for which the wind appears to be not so well adapted.

The hilly and undulating nature of Scotland, supplies water falls so numerous and powerful, that windmills have not been much used there for grinding flour. But in the South of England, where the surface is more of the character of flat or slightly undulating plains, windmills are more common, and have generally done well, and realized ample fortunes to many of their owners. When the owners or tenants of flour mills, driven by wind, have sufficient capital, the mill can be employed night and day so long as there is wind; and as comparatively few hands are employed about a flour mill, they might be usefully engaged, during calms, in dressing the mill stones and doing other necessary work in the mill; these remarks also apply to saw-mills, employed in cutting home-grown timber; during calms the hands could be employed in sharpening and adjusting the spare saws, and bringing forward and preparing timber for the mill.

Windmills may be arranged into two classes—viz., those of the vertical, and those of the horizontal construction. Much ingenuity has been expended in endeavouring to improve the horizontal mill, which has never been attended with much success. In fact, machines presenting so much obstructing surface in the plane of motion, while moving in a medium of the same density as that by which they are impelled, must suffer great retardation. From the nature of the horizontal mills little more than one vane can be acting at a time, and the motion of the vanes must of necessity be considerably slower than the moving wind, while in those of the vertical construction all the sails act together, and generally attain a speed much higher than that of the cylinder of wind which impels them. The writer has occasionally travelled 16 miles an hour in the canoes employed on the south coast of Ceylon, when the wind was blowing a pleasant 7 knot breeze; these canoes are 40 ft. long, and are formed of a light timber which the natives call "dombay" wood. The lower part, which is nearly parallel throughout its length, is only 2 ft. wide, and formed of the trunk of a tree hollowed out; and the sides, which are 2 ft. high, are composed of deal 2 in. thick, and attached to the bottom with coir yarn, obtained from the cocoa nut; the ends of the canoe being rounded on the horizontal plane, and sloping considerably outward and upwards on that of the longitudinal and vertical planes. They are rigged with two masts of bamboo, which carry very large lug sails of cotton cloth. The transverse stability of these canoes is obtained by an ingenious appliance termed an "outrigger," which is attached at a distance of 12 or 14 ft. from, and parallel to the canoe, and when sailing with the outrigger on the weather side, two of the boatmen sit upon the outrigger to enable them, by this addition of weight at the windward side, to carry more sail. These canoes are found to travel best without any paint or pitch applied to their bottoms, the immersed part being simply made as smooth as possible. They have no rudder, and are steered with an oar, and with a moderate wind on the beam they often outstrip the fastest of the Peninsular and Oriental Company's steamers.

About seventy years ago, a master mariner, residing at Dunbar, in Haddingtonshire, devised a novel windmill on the horizontal construction. It consisted, essentially, of an upright shaft, which carried four arms, at the extremities of which were four masts, rigged with try sails, and the sheets were adjusted so that the sails might take their proper positions, according as they were acted on by a beam wind, "booming out," or coming up in the "wind's eye." A mill, so constructed, would not possess the important element of durability, as the violent jerks imparted to the sheets would very soon snap them. Several mills on the horizontal construction were in use at the town of Eli, in the litigious kingdom of Fife, at the end of the last century, and were employed in grinding indigo; but they have long since been removed.

In the 12th century, when windmills began to be more common, a dispute arose whether the tithes of them belonged to the clergy; and Pope Celestine III. very considerately decided the question in favour of the Church.

About three or four centuries ago, the avaricious landholders, favoured by the meanness and injustice of government and the weakness of the people, extended their regality or kingship not only over all streams, but also over the very air, and mills which it impelled, so that small proprietors, before erecting a windmill upon their own property, had first to obtain permission from the superior of the province before doing so.

The early mills were immoveable, and could only work when the wind was in one quarter; they were afterwards placed, not on the ground, but on a float which could be moved round in such a manner that the mill should catch every wind. This method gave rise, perhaps, to the invention of moveable mills.

To turn the mill to the wind, two methods have been invented, and are in common use—in the one the whole structure is arranged so as to turn on a post below; and in the other, the roof alone, together with the axle and the wings, is moveable. Mills of the former kind are called German mills, those of the latter Dutch mills. They were both moved round either by a wheel and pinion within, or by a long lever without, which acted as a stay to the structure, and which was sometimes connected at its extremity to a cart wheel, in order to facilitate its movement horizontally.

During the period of the Crimean war, the writer had an opportunity of examining several of the windmills in European Turkey, and also in the Crimea.

Around the town of Eupatoria, in the Crimea, there appeared to be nearly 200 windmills, chiefly employed in grinding corn; and all which were in a workable state were of the vertical construction, and only one horizontal mill, which seemed to have been out of use for at least a quarter of a century. The tower of this mill was built of brickwork, about 20 ft. diameter at the base, and about 17 ft. at the top, and 20 ft. high; the revolving wings, which consisted of six sets of arms, appeared to be about 20 ft. diameter and about 6 ft. broad, fitted with vertical shutters, which were moveable on pivots passing through the arms, the shutters being each about 12 in. wide by 5 or 6 ft. high, and the pivots were fixed at about one-third of the breadth from the edge of the shutter, in order that the wind might open and shut them at the proper time, during the revolution of the wings. About one-third of the circumference of the wings was surrounded by a segmental screen to shelter the arms and shutters while moving up against the wind, and the screen seemed to have been hauled round with ropes, in order to suit the direction of the wind.

The writer also examined one of the most recently erected mills on the vertical construction, which had the words "Moulin Français" inscribed upon the door, by way of recommendation. The tower of this mill was also of brickwork, and appeared to be 18 ft. diameter at the base, and about 15 ft. at the top, and about 22 ft. high; the four wings were about 35 ft. diameter, and of a rectangular shape, about 15 ft. long and 5 ft. broad; the surface exposed to the wind was increased or diminished by the application of canvas sails, whose spread could be raised by reefing or twisting up the extreme ends of the sails when the mill was in a state of rest. The main axle, which was octagonal in form, was constructed of oak, about 15 in. diameter at the neck, and about 10 in at the rear end. The front of the axle which received the arms was square, and the two pairs of arms did not intersect the axle in the same plane, the one pair being in advance of the other; all the arms butted against the axle, and were united to it by side pieces, which were securely bolted to the arms and through the axle, which rendered mortising unnecessary, and preserved the strength of the shaft. The bearing in which the neck of the axle revolved seemed to be formed of some hard wood, probably lignum vitæ, and was lubricated with soft soap and plumbago. The rear

end of the shaft was fitted with an iron gudgeon, about 3 in. diameter, secured by iron hoops and wedges. About the middle of its length, this axle carried a face wheel about 4 ft. diameter, which was constructed entirely of timber; its arms were mortised through the axle, and secured by iron hoops round the rim, which formed the bearing surface for the friction strap or brake for arresting the speed of the mill. The teeth of this wheel, which were about 3½ or 4 inches broad and 4½ pitch, geared into a "trundle," or pinion, about 14 or 15 in. diameter, fixed on the top of a long vertical wrought-iron shaft, about 2½ in. square, which was coupled at its lower extremity to the rhynd on top of millstone spindle, the long shaft being steadied by a bearing near the centre of its length to prevent any jarring or vibration being communicated to the revolving millstones. When the writer visited the mill, the miller was engaged in laying on the revolving stones, he was thus enabled to see the working faces. The millstones were about 3½ ft. in diameter, and were formed of a single stone, similar in appearance to the white silicious burr, obtained from the quarries near Rouen. The stones were not indented with roads and channels to assist in grinding and throwing out the flour, like our flour stones in Britain, but were simply roughened or cracked with the miller's pick. The neck of the millstone spindle was guided by a bushing of hard wood, with the fibre endways, a mode of bushing employed for more than half a century in the flour mills of this country, and which, no doubt, gave the idea to Mr. Penn, of Greenwich, for his mode of bushing the screw shafts in our modern steamers, and which was better than gun metal in situations precluding the use of unguents.

When the mill was set agoing the wings, which were 35 ft. diameter, performed 29 revolutions per minute, when loaded, and the extremity of the sails acquired a velocity of about 3,200 ft. per minute, or nearly 35 miles per hour, and which showed that the "Crim Tartars" knew the importance of letting off their prime movers, a subject not too well understood by some of our British millwrights as yet.

One of the earliest windmills employed in Scotland was erected in 1720, near Dunbar, in Haddingtonshire, and was employed in making pearl barley, and, like a large portion of the barley mills in Holland (of which it was a copy), turned out an unremunerative speculation. With a moderate wind the wings had not power enough to drive the barley mill, and when blowing fresh, they often became unmanageable when the mill was being emptied of barley, and sometimes set the brake wheel on fire. A very simple plan of correcting the variable resistance would be to have two barley mills, and work them alternately; while the one was finishing the barley the other could be receiving its supply of corn, which would render the resisting load nearly uniform, and thus control the speed of the wings.

About the year 1750, Mr. Andrew Meikle, of Houston mill, in Haddingtonshire, effected several important improvements upon windmills, and was the first to devise a really useful automatic appliance for moving the sails so as to catch every wind. This he accomplished by means of a supplementary set of revolving vanes, about 10 ft. diameter, situated in the rear, and at right angles to the cardinal sails; by reducing the motion of the new set of vanes about 5,000 times, through the intervention of wheel-work, and a worm, operating upon a dead worm ring bolted to the mason-work of the tower, he caused the cap of the tower, along with the axle and the cardinal wings, to veer round to the wind, and these smaller vanes were termed the "fan tail." The next improvement which Mr. Meikle attempted was an appliance for reefing the sails when the mill was in motion. His first attempts were not attended with success; but in 1780, he devised a most ingenious adaptation of the centrifugal govenor, viz., a sliding frame on the front of the wings which operate upon rollers placed transversly with the arms, and wound up or reefed the narrow canvas sails when the wings attained too great a velocity, and the unfurling of the sails or increasing their spread was acomplished by a weight which actuated a rod passing through the centre of the main axle, and operated centripetally on the sliding frames, and then unwound the canvas when the motion of the wings was too much retarded. This was the first successful automatic reefing apparatus applied to windmills, and when the wind was not squally imparted to the vanes a precision of motion little inferior to some of our modern steam engines, and by varying the weights for unfolding the sails the power of the mill could be increased or diminished with facility.

In the year 1788, about two years after Mr. Meikle invented the thrashing machine, he applied his improved windmill for thrashing corn; and in order to illustrate Mr. Meikle's ingenuity in erecting windmills for farm purposes, it was his practice always to erect the thrashing mill previous to the wings of the windmill, and as the thrashing drum revolved upwards of twenty times faster than the main axle, the gearing of the thrashing mill formed a convenient crane for elevating the wings after being attached one by one to the axle at the lower part of this circuit. Mr. Meikle was described by those who knew him as possessing much shrewdness and originality in his profession; and, with the exception of the late Mr. Smeaton, and the elder Rennie, who was Mr. Meikle's pupil, was one of the ablest millwrights of his day, and died poor and unrecompensed for his many useful inventions.

In the year 1758, the late Mr. John Smeaton instituted a series of experiments with a model windmill about 2 ft. diameter, in order to ascertain the best shape and angle for the sails of windmills. In the experiments referred to, the air was in a state of rest, and a progressive motion was communicated to the mill by means of a determinate weight acting by means of a cord coiled round an axis with a horizontal arm, at the extremity of which were four small moveable sails; thus the sails met with a constant and equable blast of air, and as they moved round, a cord with a weight affixed was wound about their axes, and they showed what construction of sails and "angle of weather" produced the best effect. From these experiments, Mr. Smeaton concluded that the angle of weather, with the plane of motion should, at the extremity of the sails, be 7 deg., and at the middle 18 deg., and at the centre 18 deg., to produce the best effect. But it is an ascertained fact that the angles of weather, instead of being a constant quantity, should be varied according to the velocity with which the sails are intended to move; when the extremities of the sails are intended to move at 35 miles per hour, the angle of weather should be less than when a speed of only 20 miles an hour is contemplated.

When the sails are planes, and when the extremities move at 30 miles per hour, it has been ascertained that the best angle of weather, with the plane of motion, is 16 deg. A plane, although the best form for the sails of a ship when operated on by a beam wind, and when every part of the sail recedes from the wind with the same velocity, does not apply in the case of revolving sails, where the velocity varies, according to the distance from the centre of motion, and the sails accordingly should be considerably twisted to obtain the same angular velocity, and in order that the moving wind might operate with a uniform purpose over the whole surface of the sails, and the cylinder of wind recede from the sails with a uniform flow. When revolving sails have the form of a plane, the useful area is virtually diminished; and it is a fact worth recording, that the sails of the windmills employed in Holland, have considerably more twist than those in Britain.

With reference to the number of sails it is most advantageous to employ, there appears to be a diversity of opinion among millwrights. Four, however, is the most common number employed in Holland, Germany, and France, and also in the South of England. About twenty years ago, some experiments, on a large scale, were made by a millwright residing near Hull, on a mill which had four sails, which were carried away during a gale. When the mill was re-erected, five sails were substituted, the collective area of which was identical with that of the four sails formerly employed. It was found that the five wings or sails produced a better effect than the four previously employed. This improvement was attributed to the wind escaping more freely from the sails, which produced a more steady action, and less reaction or relaxing of their effect or power while passing the tower. The next experiment had eight radiating or tapering sails, which promised good results; but having encountered a hurricane shortly after its erection, all the eight sails were carried away. Perhaps the principal objection to mills having more than five sails, is their increased first cost, and also the increase of trouble attending their management; so that, all things considered, five sails are found to be the most suitable number in practice; and when a mill with this number of sails is in a state of rest, three of the sails are brought below, and two upwards, in order to lessen the effect of the wind upon the structure.

The conical pendulum, or centrifugal governor, originally devised by Huygens about the middle of the 17th century, to regulate the movement of clocks, was applied by Hooper in 1789 to control the motion of flour mills, impelled by wind. In a windmill, when the velocity is increased by the irregular action of the wind, the grain is sometimes forced rapidly through the mill without being sufficiently ground, and by means of the centrifugal force of one or more balls, which fly out as soon as the velocity is augmented, and by operating on a combination of levers in connection with the bridge of the stone, to increase the power, and to diminish the travel, causes the revolving millstone to descend, and bring it in nearer proximity with the bedstone, thus increases the resisting load on the mill, and this appliance is in some parts of England termed a "lift tenter." In the early part of the present century, William Cubitt (afterwards Sir William Cubitt), then a millwright, residing at Ipswich, devised a mode of reefing the sails of windmills, by introducing moveable shutters on the wings of the mill, which shutters were closed by a governor, like that of the steam engine, operating upon a rod passing through the centre of the main axle. These shutters were suspended on pivots fixed about one-third of their breadth from one side, and when the wind was blowing too strong it opened the shutters and allowed a portion of the wind to pass through them, and so also checked the velocity of the mill. Perhaps an improvement upon Mr. Cubitt's plan might be effected by springs instead of weights to close the shutters, and arranged so that the centrifugal action of the shutter would open them. It is believed that a reefing apparatus so constructed would operate with greater uniformity, and be as sensitive as a properly balanced steam engine governor.

The largest windmills in Britain are to be found at the town of Great Yarmouth, in the county of Norfolk. The wings of some of these mills describe a circuit of 100 ft. diameter, and with a moderate breeze drive six pairs of millstones 4 ft. 6 in. in diameter, grinding collectively 30 bushels of flour per hour. The main shaft is generally constructed of oak, about 3 ft. in diameter, its main bearing being lined with strips of iron 1¼ in. broad, and ¾ in. thick, sunk longitudinally into it, and fastened with screws and spring hoops, so as to form the main journal of the shaft which revolves in a bearing bush or brass. The "stock pieces" to which the arms are fixed are mortised through the axle. This first motion shaft carries the usual face wheel, which is made of cast iron, about 12 ft. in diameter (the rim of which forms the bearing surface for the brake), and gears into a main pinion or "wallower" about 4 ft. in diameter, fixed on the top of the upright shaft. This shaft carries at its lower end a spur wheel, about 14 ft. in diameter, which drives the spindles of six pairs of millstones which are posited around it, each pair being fitted with a "lift tenter."

In order to maintain the efficiency of windmills, it is of much importance that the wood and iron work should be of the best description; the main axle should be of wrought iron, having a cast-iron flange of large diameter keyed on its front, and furnished with recesses for receiving the arms of the wings. The brake-wheel should be strongly constructed, and covered with hard wood, and of ample breadth, as well as that of the friction strap, which should be strongly secured to the framing at the top of the tower; and it would be an improvement to have a small force pump worked from the top of the upright shaft to discharge water upon the break-wheel, when the mill requires to be arrested in a gale of wind.—*Practical Mechanics' Journal.*

The Liverpool Shipowners' Association, at a meeting held on Saturday, adopted a report which recognised the necessity of an early revision and readjustment of the dues levied upon vessels using the graving and other docks of the port. Amongst other things, the Association recommended that the charges for the graving docks in all instances should be regulated by the length of the vessels and the time of occupation. With respect to the wet docks it was recommended that at the time of every vessel—whether steam or sailing—entering she should pay tonnage dues on her gross tonnage, which should entitle her to remain in the dock for a fixed period, and that in addition every vessel should pay for the quay space occupied in discharging or loading her cargo according to the extent of space and time of occupation.

MUSGRAVE'S IMPROVEMENTS IN STEAM BOILERS.

FIG. 1

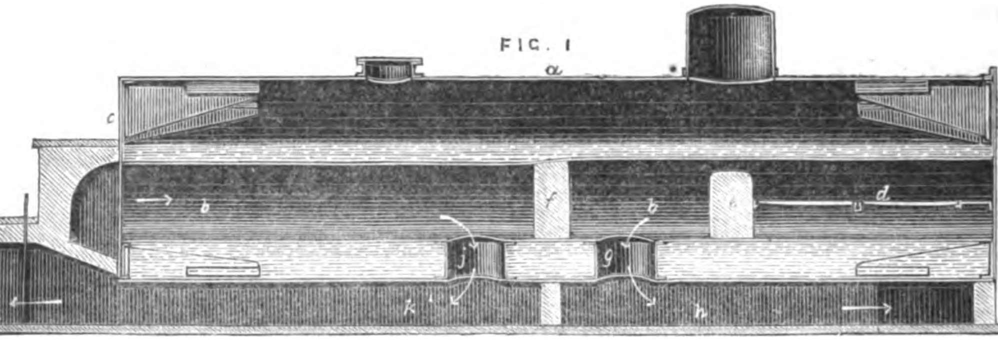
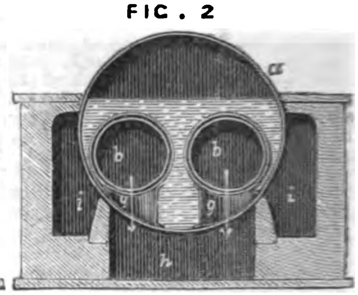


FIG. 2



MUSGRAVE'S IMPROVEMENTS IN STEAM BOILERS.

THIS invention, patented by J. Musgrave, engineer, Bolton, is applicable to steam boilers having two longitudinal flues containing at one end the fire grates; these flues extend from one end of the boiler to the other and impart the requisite strength to the ends but they are closed near the bridge at the firing end either by partitions of fire-brick or otherwise. The products of combustion descend through vertical flues into an external horizontal flue; they then pass along external flues to the end of the boiler, where they enter the end of the internal flues, from whence they descend through vertical flues into an external flue which is in communication with the chimney.

FIG. 3

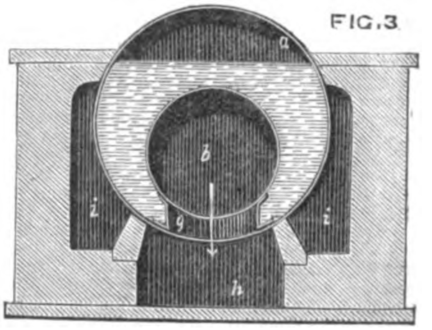


Fig. 1 is a longitudinal section of the improved boiler; fig. 2 is a transverse section through the firing flues of the same.

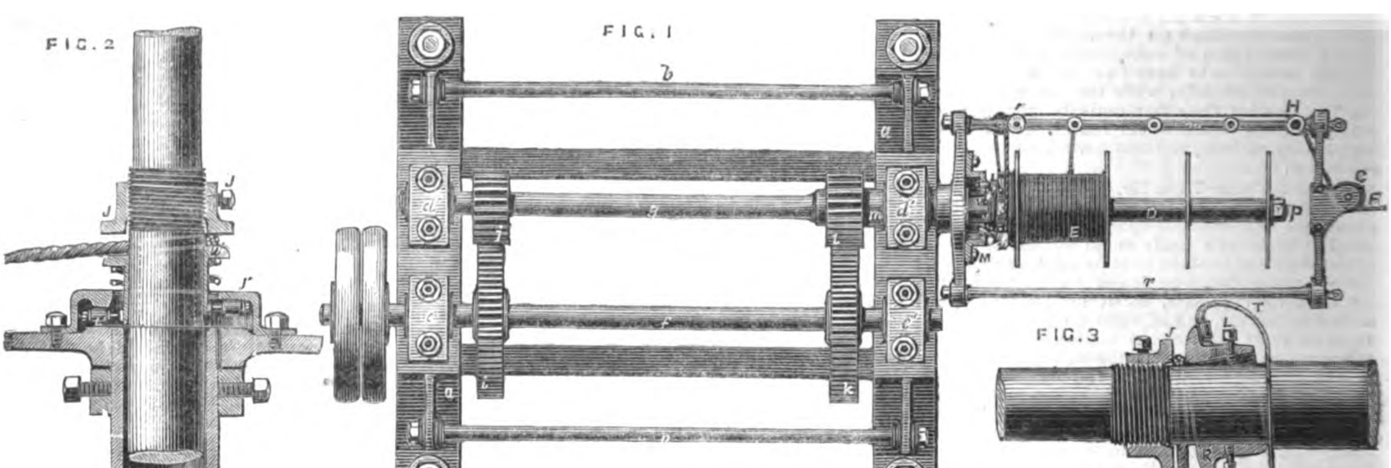
a is the outer cylindrical casing of the boiler; *b*, *b*, the two internal flues extending from one end of the boiler to the other, thus imparting the requisite strength to the ends *c*, *c*. The flues *b* are rather larger at the firing end than at the other, to give space for the grates *d*, *d*, and bridges *e*, *e*. The flues *b* are closed at about the centre of their length by the partitions *f*, made by preference, of fire-bricks. The products of combustion, passing over the bridges *e*, pass through the vertical flues *g* into the external longitudinal flue *h*, which conveys them towards the firing end of the boiler, where the longitudinal flue *h* branches upwards and conveys the products of combustion into the side flues *i*, which extend the whole length of the boiler, and deliver them into the ends of the internal flues *b*, from which they descend through the vertical flues *j* into another external flue *k*, which is in connection with the chimney.

Fig. 3 shows an end view of a boiler constructed according to a modification of this invention. In this view the boiler is made with a single flue *b* containing the fire grate and bridge. The products of combustion, after passing over the bridge, descend through the vertical flue *g* to the horizontal external flue *h*, then into the side flues *i*, from whence they return into the internal flue *b*, and again descend through the vertical flue *j* to the external flue *k*, which communicates with the chimney.

In boilers of the ordinary construction with internal flues, it is well known that the expansion is very unequal, particularly when the steam is being raised rapidly on starting; this unequal expansion is due to the upper surface of the flues, and the upper portion of the cylindrical shell of the boiler, being heated before the lower parts; but in the boiler above described such unequal expansion cannot take place, as the upper and lower parts of the boiler, both internally and externally, are heated equally at the same time, thus establishing a complete circulation of the water in the boiler as soon as the fires are ignited.

BROOMAN'S IMPROVEMENTS IN THE MANUFACTURE OF ROPES, CORDS, CABLES, &c.

FIG. 2 FIG. 1 FIG. 3



BROOMAN'S IMPROVEMENTS IN THE MANUFACTURE OF ROPES, CORDS, CABLES, &c.

THIS invention, patented by Mr. R. A. Brooman, Fleet-street, is based upon the proportional resistance of the strands composing the cord, rope, or cable, according to their thickness or torsion—that is to say, that if in a rope composed of four or five strands, and manufactured according to the ordinary method, there be one or several of different thickness and of unequal torsion, the strain borne by the entire rope being equally spread over each strand, the weakest will break first, consequent upon its want of resistance comparatively with the others. Each strand will thus break successively, as the resistance offered by the entire rope is no longer sufficient to resist the strain exerted upon it.

By the method of manufacture which forms the subject of this invention, the whole strain is, on the contrary, spread proportionally over each strand according to its thickness and torsion. The result is, that the rope is capable of exerting its maximum tension without breaking.

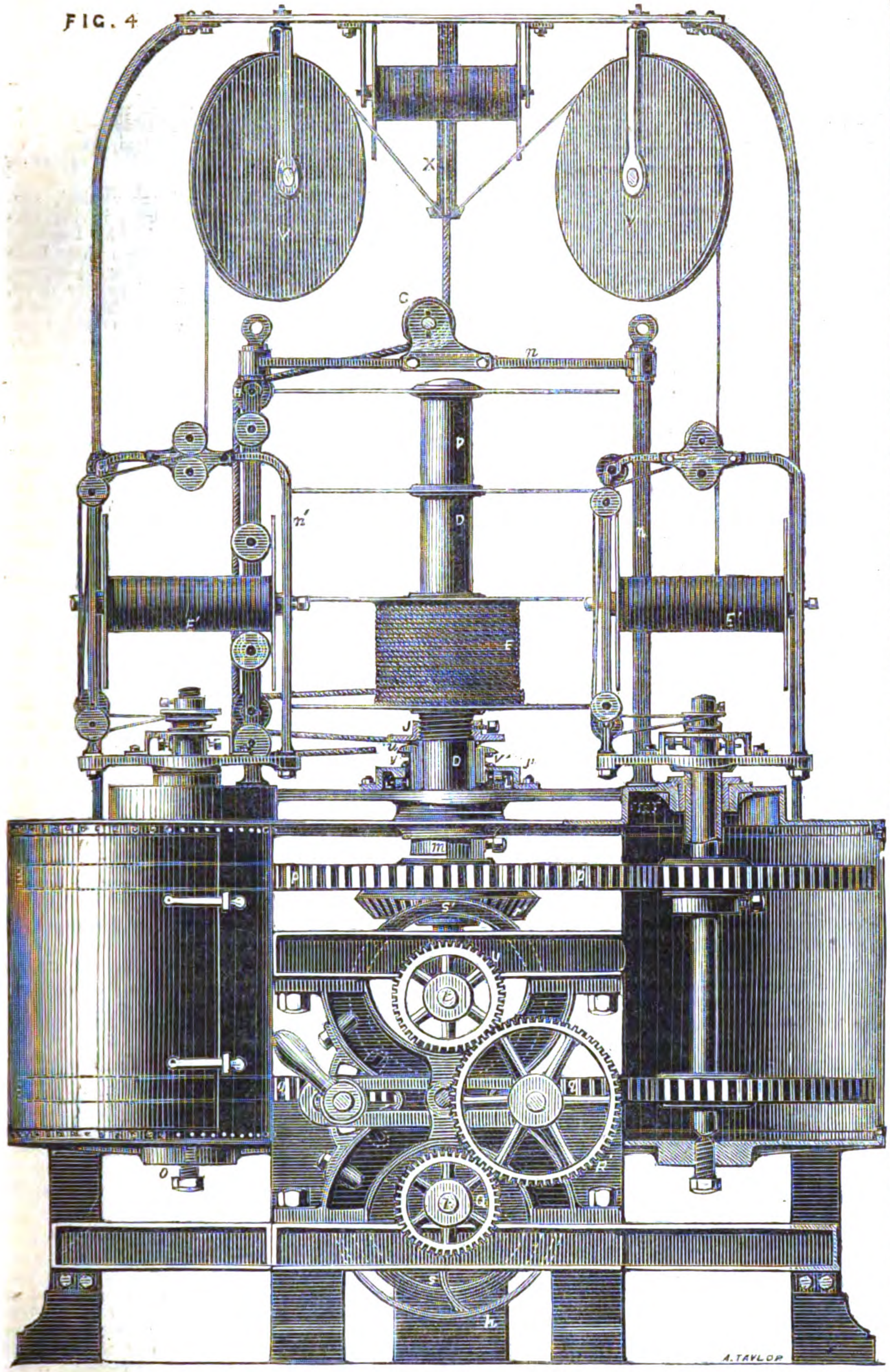
The manufacture, according to the present invention, is divided into three distinct operations—viz., spinning, winding or warping, and twisting. These three operations are performed in two machines—viz., a spinning machine, which performs also the winding and warping; and a twisting machine. These two machines will be well understood on reference to the accompanying engravings.

Fig. 1 is a plan of the spinning machine; fig. 4 is a sectional elevation of the twisting machine, taken at the top of the mechanism for driving the flyers; figs. 2 and 3 are details on a larger scale of the different arrangements applied to the flyers for nipping.

First Operation, Spinning Machine.—This machine is mounted on frames *a*, *a*, of cast iron, wood, or other material, united by cross bars *b*. On the frames *a* bearings are fixed, in which shafts *f*, *g*, are free to revolve. The main shaft carries two pulleys, one of which is loose; inside the frame

BROOMAN'S IMPROVEMENTS IN THE MANUFACTURE OF ROPES AND CORDAGE.

FIG. 4



is a toothed wheel i, which gears into a pinion j, fixed on the shaft g of the spindle D. A second toothed wheel, fixed on the shaft f, gears into a pinion l on the socket of the flyer n. The pinion j which drives the spindle D and the pinion which drives the flyer being of different diameters proportional to the wheels, the wheels turn in the same direction, but at different speeds. The object of this arrangement is to impart at the same time a twist to the strand and to wind it upon the bobbin E, as will be explained in the description of the flyer and its operation. The hemp for forming the strand is kept stretched at F, and becomes twisted by the flyer, which makes 500 revolutions a minute. The strand then passes under a grooved roller G, then over another grooved roller H and a third grooved roller I. On leaving the roller I the strand is nipped between a grooved cap J and a hinged nipper on the socket K. The nipper carries two rods L, to which rollers are attached abutting interiorly against an eccentric ring M fixed on the rail of the flyer. Springs pressing upon the nippers cause them to press against the cap J. The cap J is threaded as represented in figs. 2 and 3, in order that its position may be regulated according to the thickness of the of the strand. The flyer in revolving carries with it the eccentric ring M, which by pressing upon one or other of the rollers L opens first the nipper u, then the nipper u^1. The strand is in turn seized by one of these nippers, and released by the other as the flyer and spindle revolve; it thus receives sufficient tension to allow of its passing over a pulley N, and over one of the rollers o, o, o, which facilitates its winding on one of the compartments of the bobbin or drum E. When the bobbin E is full, it is removed by unscrewing the bolt P, and an empty one is substituted for it. The nipping apparatus may be varied, as shown. In the apparatus shown at figs. 2 and 3, the nippers u, u^1, have substituted for them slides carrying rollers L^1, L^1, which pass under the cam J_1, and the nippers of each slide are pressed upon by springs, as already explained. Or a socket R (see fig. 3), widened at the bottom, may be made to oscillate round the spindle S. This socket is kept pressed against the grooved cap J by the roller L^2 fixed on the end of a strong spring T. Or the spring may be placed under the cam or eccentric ring; but in that case, the eccentric would push the lever or nipper from above, instead of acting from below as before. The object of these different arrangements is to retain the cord at a given moment nipped between the cap J and the appliance for pressing, in order to obtain the necessary tension.

Second Operation, Warping.—The warping of the spun strand is effected in a machine precisely similar to that above described, but of larger proportions. The bobbin carrying the spun strand is placed on the spindle of the machine, which imparts to it a regular torsion before being submitted to the twisting machine.

Third Operation, Twisting.—This machine consists of a circular or polygonal frame Fig. 4, A, supported on four or six cast-iron feet. The circumference is divided into four parts, on each of which is a drum B, of sheet iron fixed to the frame A by rivets, or by any other mode of attachment. The two bottoms of the drums are formed by plates o, cast with the frame and strengthened by ribs. In the centre of the frame is a vertical shaft p supported by bearings and collars; it is prolonged above the frame and forms the spindle D, or rather the axis of the drum E. On the shaft p, a large toothed wheel q is fixed concentric with the bevel wheel r, which receives motion from another bevel wheel s on a horizontal shaft t, on which the driving pulleys h, h^1, are fixed. Outside the frame, and on the same shaft t, there is a toothed wheel Q, which, through the wheel R^1, actuates the wheel U on a horizontal shaft t_1. This shaft is similar to the shaft t, with the exception of the driving pulleys; it carries a bevel wheel s_1 in gear with the bevel wheel r^1, in a piece with a large toothed wheel p^1 on the socket m of the flyer n. Four small flyers are arranged round the central spindle to receive the spun and warped strands. The flyers and spindles are arranged, as has been already mentioned, for the spinning and warping machine, and carry drums or bobbins E^1 placed horizontally, from which all the strands for forming the rope or cable proceed. Each strand on leaving the flyer n^1 is subjected to torsion, and passes over a large pulley V, and then through a guide or "twizzle." On leaving the twizzle the strands become united in one, either by themselves alone or round a central core X, as seen in fig. 2. When the rope or cable is being formed—that is to say, when the large central flyer n and the drum E work—each of the strands, according to its torsion or size, becomes more or less elongated, the thickest becomes first placed on the core, if there is one, then the strand next larger, and so on for all the strands; this is supposing there be inequality in the strands. Thus a rope or cable is formed, all the parts of which are equally distributed in proportion to the resistance they are capable of presenting. When all the strands are equal in diameter and torsion, they become twisted together and form a strong and even cable. The rope becomes twisted and wound upon the drum on the main spindle in a similar manner to the winding of the strands upon the bobbins, as before explained. The twisting machine may be arranged horizontally—that is to say, the three or four spindles which carry the strands may be placed at a distance of, say, six or seven feet from the twisting spindle which is in the front—and may be worked by a driving shaft or by pulleys. The chief object of the large pulleys is to facilitate the passage of the twist of the strand, which, when it has once entered the groove of the pulley, cannot be again diverted until it arrives at the twisting spindle; this is an essential feature in this invention.

EXPERIMENTS AT SHOEBURYNESS.

An important series of experiments was made on Tuesday at the practice ground of Shoeburyness, in presence of an unusually large assemblage of naval and military officers, and other scientific persons interested in the subject of artillery and iron-plated ships, besides the members of the Iron-plate Committee and the Ordnance Select Committee, under whose especial direction the experiments were made. The presence of his Royal Highness the Prince of Prussia added to the interest of the occasion, and his Royal Highness appeared to take great interest in witnessing the effects of heavy guns against one of the strongest iron targets that has ever been experimented upon. This target, like those which have been tried before, was to represent a section of the side of an iron ship-of-war, stronger it is supposed than either the "Warrior" or the "Minotaur," a ship which is already named the "Bellerophon," although she is not yet commenced, and is designed by Mr. Reed, the present Constructor of the Navy, to surpass all that has yet been done in building iron-plated ships of war. This target is called, therefore, the "Bellerophon" target, and it has been constructed at the Millwall Ironworks, by order of the Lords of the Admiralty.

The following is a description of the target:— It was 20 ft. 9 in. long, by 8 ft. 6 in. high, composed of rolled armour plates 6 in. thick, backed by 10 in. of teak, and two ⅝-inch plates for skin. Two external longitudinal stringers are wrought behind each armour plate through the whole length of the target. The two behind the lower plate are formed of angle iron 10 by 3½ by ½, and those behind the upper plate of angle iron 9½ by 3½ by ½. Frames 2 ft. apart. The bolts in the lower plate are 2¾ in. diameter, and those in the upper 2½ in., and have conical heads. The 2¾-in. bolts are double nutted, and the 2½-in. single nutted.

It was generally considered by those who had seen the other targets that this was a most excellently made one, and of very great strength. It will be remembered that the target fired at in March last had three plates of different thicknesses, 5½ in., 7½ in., and 6½ in., with 9-in. teak backing, and an iron skin of 2 in. thick.

It was arranged by the Ordnance Committee that the upper plate was to be tried by 68-pounders, or, strictly speaking, with cast iron shot weighing 66½ lbs., and the Armstrong 110-pounder service gun, with shot of the same weight, and the same charge of powder. The range was fixed for all the rounds throughout the day at 200 yds., which was the same as that taken against the "Minotaur" target. The first round with the 68-pounder produced the usual dent of about 2¼ in. into the plate. The second round was the Armstrong 110-pounder, with 66½ lb. solid and conical headed shot; this made a very similar dent to that of the 68-pounder.

The third round was a salvo of two 68-pounders and three Armstrong 110-pounders, with the same weight of shot and the same charge of powder as the 68 pounder. This terrific attack the target bore without much evidence of injury, though it is true the one Armstrong missed fire and one hit the very top edge of the target, breaking the angle iron behind. The other shots merely indented the plate.

The lower plate was now to be fired at by the heavy Armstrong guns of the service, and by the Whitworth shell, with an entirely new gun expressly made by order of the Ordnance Select Committee, a muzzle-loading gun which has for some time past been mentioned as a gun intended to serve as a broadside gun for the Navy.

The first round fired at the lower plate was intended to have been one from the ordinary 68-pounder, but the effect of these shots being so well known, this shot did not come off, and in its place was fired the Armstrong 110-pounder, with 16 lbs. of powder and a hardened steel shot. The effect of this was to make an indentation and start a bolt, a result much less than was expected. The second round was from the smaller Whitworth gun of 5¼ in. calibre, with shell of 70 lbs. weight and 2 lb. 6 oz. bursting charge, and 12 lbs. charge. The shell, which is of steel, and flat-headed, struck about a foot below the upper edge of the lower plate, penetrating about 1½ in., and starting a bolt. The third round was from the new gun described as a 7·1-inch calibre, 16 lbs. charge, steel shell 117 lbs., with a bursting charge of 2 lbs. To the astonishment of every one, and most of all the Ordnance Select Committee, this gun produced very little effect upon the target—not much more, as it was remarked, than if a Dutch cheese had been fired at it from a cross-bow. The next round set down in the programme was for the 7-inch Whitworth gun, the same gun that sent the shell at 800 yds. through the "Warrior" target in November, 1862, and which was made at the Royal Gun Foundry. The shell fired from this gun weighs 151 lbs., and contains a bursting charge of 5 lbs., the charge being 27 lbs. The first shell fired from this gun burst at a short distance from the gun, and as there was no other shell prepared and ready, some delay arose, and it was necessary to proceed with the firing of the larger Armstrong guns while another shell was being prepared. We learnt that there were no flannel bags ready for holding the bursting charge, and as this is indispensable to the proper action of the Whitworth shell, it was necessary to extemporize one, and this was fortunately done under the instructions of Mr. Whitworth himself, who was present, otherwise the men were about to fill the shell with loose powder, in the way that the old shell is filled —a blunder that would have effectually prevented nearly all the power of the shell from being exerted. The shell was, however, ready before it grew dark, and was the last shot fired.

The 10-in. Armstrong smooth-bore gun, muzzle loader, was now fired with a 150-lb. spherical shot of cast iron, with a charge of 35 lbs. The shot missed the lower plate, and struck the upper one about 3 ft. 6 in. from the mark, indenting it and starting a bolt.

The same gun was now charged with a steel spherical shot of 150 lbs., with 35 lbs. of powder; the effect of this was to strike the plates at the part where they joined. The shot buried itself just below the face of the plate, and therefore went through it and into the wood. One frame was broken, and the skin was bulged and slightly cracked. The next round was from the 300-pounder Armstrong, 10-in. calibre, 35 lbs. charge, and a solid cast-iron shot. It struck fair on the upper plate, however, produced very slight penetration with some few cracks in the direction of the dents made by the 68 and 110-pounders, and it broke a rib behind the target. The velocity of this shot was 1,150 ft. per second, and that with the 150-lb. shot was 1,500 ft. per second at the time of impact, showing the great importance of velocity for penetration.

The last round fired was with the Whitworth shell from the 7-in. gun. This penetrated quite through the plate, bursting in the timber backing and bulging the skin, opening out the plates at a junction where they were rivetted about an inch and a half. This result, therefore, tended to confirm the previous reputation of the Whitworth shell, as it was the increased thickness of the plates by very nearly two inches which only prevented the shell getting into the ship as it did in the "Warrior" target. It would appear that it is only necessary, therefore, to increase the calibre of the shell and the gun to penetrate the "Bellerophon" as easily as the "Warrior." It should be noticed of these experiments, as in the trial against the "Minotaur" target, that the Whitworth shell, with a charge of nearly 10 lbs. less powder and a gun of 3 in. less calibre than the heavy Armstrong, proves to be a more effective weapon against iron plates.

The target on this occasion certainly came off victorious; and though the Committee's great gun was "nowhere," the Admiralty may feel some confidence in laying down the "Bellerophon."—*Daily News.*

THE LIGHT DRAUGHT MONITOR "YAZOO."

One of the twenty light draft monitors ordered in March last by the Government, is fast approaching completion at the extensive shipyard of Wm. Cramp and Sons, Kensington, Philadelphia. The "Yazoo" will be 225 ft. in length over armour, breadth of beam 45 ft., and a total depth amidships of 9 ft. 1 in. The vessel will have a flat bottom, with 1 in. dead rise, the bilge to be formed by a radius of 15 in.

The sides of the inner hull are vertical, surrounding which is another iron hull, having also vertical sides, the depth of which is 3 in. less than that of the inner. The space between these hulls is arranged so as to be filled with water at pleasure, for the purpose of giving the vessel greater draft, and bringing the deck near the surface when in action. The interior of the vessel is divided into compartments by water-tight bulk-heads of plate iron, communication between them being afforded by wrought-iron water-tight doors. The water compartments will be filled and emptied by two powerful pumps, each capable of delivering three thousand gallons per minute.

For propelling the vessel, two engines, working entirely independent of each other, are to be used. The cylinders of each will be 22 in. diameter, and 30 in. stroke of piston. These are to be connected with two propellers of cast iron, each 9 ft. in diameter and 12 ft. pitch. The surface condenser will have 3,294 in., with a cooling surface of 2,500 square feet. There are to be two horizontal tubular boilers, each to have four furnaces, with a grate surface of 150 square feet, and a fire surface of 4,120 ft.

There are also to be two circulating pumps, with a double oscillating engine for driving them. The draft of water for this vessel when loaded, will be 6½ ft.; area of water line, 7,140 square feet; displacement at water line, per inch of draft, 17 2-10 tons; and total displacement, at 6½ ft. draft, 1,175 tons. The work on this monitor is of a superior character, and will again add to to the reputation of her builders. The plating and backing of wood, size of turrets, construction of deck and interior, being the same as the old monitors, a description is rendered unnecessary.—*New York Army and Navy Journal.*

PROGRESS OF A YORKSHIRE SMELTING TOWN.

Twenty years ago, says a correspondent, Cleveland enjoyed all the quiet stagnation of agricultural life. Since then a rapidly increasing tide of progress has set in. Then there was only one railway with an arm extending about three miles into the district to Middlesborough Docks. Now our railways, without reckoning innumerable sidings, branches to mines, and to private works, are at the least 67 miles in length, and managed by three companies. Then Eston was a hamlet with the most meagre population, now it numbers 5,000 souls. Middlesborough from 7,000 has sprung to nearly 25,000. South Stockton from other parts of the kingdom has drawn in a population of 7,000. The new towns and villages of Saltburn-by-the-Sea, Eston Junction, New Rosedale, and South Bank have sprung up, and the old places have experienced almost a resurrection. Iron mines employing thousands of hands have been opened at Eston, Upsil, Hutton, Low Cross, Ingleby, Upleatham, Staithes, Swainby, Hinderwell, and other places, and from these hundreds of thousands of tons of iron-stone are annually extracted. When the Cleveland ore was first opened out at Skinningrove and a cargo brought to the Tees, one of our present leading firms rejected it as being little better than quarry rubbish. Circumstances, however, led them to alter their decision, and the oolitic beds of Cleveland have exerted, and are yearly exerting, more and more influence upon the iron trade of this country, whether in iron ships, iron rails and bars, mechanical combinations of iron, or crude pigs for export or for home manufacturing purposes. Just now nearly a score of new furnaces are being built in the district, involving great outlay of capital, and several new iron ship yards are projected. New railways are in progress, and new mines are about to be opened at Skelton, Skinningrove, Hunteliff, and other places. On the part of the Established Church, new churches, mission rooms, and schools have been and are being built; and the Nonconformists, never last in the field, have dotted the new towns with religious structures, many of them of large dimensions.

THE INDIAN TELEGRAPH.

Colonel Stewart, Sir Charles Bright, Captain Stewart, Mr. J. C. Laws, and Mr. F. C. Webb have arrived at Malta in the steamship "Valetta," from Marseilles, and passed on in the same vessel for Alexandria, for the purpose of superintending the laying of the electric cable in the Persian Gulf. The five ships forming the squadron for conveying the cable to its destination will rendezvous at Bombay, whence they will proceed to lay their respective sections. The submergence of the cable is to commence as soon as possible after their arrival. The staff of electricians, telegraphists, &c., have been sent in the various cable ships, all of which have left England, and the early ones must now be near Bombay. The submarine line will be laid in four sections between Bussorah, at the head of the Persian Gulf, and Kurrachee, having intermediate stations at Bushire, Khasab, and Gwadel. The land line from Bussorah to Bagdad, and thence through Asia Minor, is being proceeded with with all possible despatch. The persons connected with the undertaking who passed through Malta said that they expected to have the line in working order within six or seven months from the present time.

ON MAGNETO-ELECTRICITY, AND ITS APPLICATION TO LIGHTHOUSE PURPOSES.*

By F. H. Holmes, Esq.

As this is a Paper on the Application of Magneto-Electricity to Lighthouses, I will begin by saying a few words on lighthouses themselves, their former and present state, and the systems now generally followed in the arrangements for lighting.

Formerly, lighthouses were very few, and were nearly all coal fires on high cliffs or towers, and most of them were the property of private individuals; but, as shipping increased, so the lighthouse system became more and more developed, both in the number of lighthouses and in the improvement of those already existing. The coal fire gradually gave way to the oil lamp and candles; next we find the introduction of spherical mirrors or reflectors; and these, again, were superseded by parabolic reflectors, sometimes to the number of more than thirty in one lantern. After this came the introduction of the "Fresnel Lens," which took the place of the reflectors and their lamps, however numerous they might be, and required instead one central lamp.

This "Fresnel Lens" has again grown, so to speak, larger and larger, as the want of a more powerful light was felt, till it has now a diameter of 6 ft. and a height of 10 ft., for to increase the quantity of light the size of the lamp must be increased, and the lens in proportion, or it would have been so far out of focus that the intention of the lens would have been frustrated.

To make these progressive improvements in lighthouses vast sums of money had to be expended; and now let us see what was the end sought:—First, to improve the light itself. This is done by the substitution of a lamp of four concentric wicks (the largest nearly 4 in. in diameter) for the coal fire. If the improvement had stopped at that, it would have been small indeed, but this lamp is more under command than the coal fire. The value of the introduction of oil is not so much then, on account of its greater power as for its aptitude for the employment of economizing apparatus, whether this consists of reflectors or lenses. All incandescent bodies give out rays as it were from the centre to the circumference of a sphere; of such rays, only those which fall on the sea would be useful to the mariner; but by means of reflectors those rays which would pass inland, or upwards, or downwards, are reflected towards any required point, and by a proper arrangement of a series of reflectors, the whole or nearly the whole of the rays, are directed where required. The Fresnel lens consists of a middle refracting belt, and a double series of reflecting prisms, or zones, as they are generally termed, and, when properly constructed, it has the property of collecting all the rays into one horizontal beam, so that all the light from the lamp is utilized. Thus, then, we see great strides have been made since the introduction of oil lamps, as regards the lenticular apparatus—in fact, that may be said to be nearly perfect; let us then return to the consideration of the light itself for a moment.

Whether a large or small lamp be employed it will make no difference in misty weather, so long as the thickness of the flame is the same, for a large lamp may be equal to ten or twelve smaller ones, and, if replaced by these ten smaller, it will be evident that when one of these is obscured by mist the whole of them will be obscured. Quantity of light, then, will not add to its power of penetrating mist. By making the large lamp with four concentic wicks, the intensity of the light is a little increased, and such a lamp will penetrate further through mist in a slight degree. But it is in misty and hazy weather that the light is most required; hence, now that everything is nearly perfect in a lighthouse, the authorities, both in this county and elsewhere, are directing their attention to the only thing wanting to make the whole system perfect, that is, a light capable of penetrating mist; and as this power depends on the intensity of the light, and electricity is capable of producing the most intense light known, it was naturally looked to as the possible means of perfecting the whole system. But the light produced by electricity, to be applicable for lighthouses, must be certain and constant, not liable to extinctions or any great variations, as the first would tend to endanger vessels seeking and not finding the light; and if a fixed light had much variation, it might be mistaken for a revolving light.

Let us now see whether electricity can produce a constant steady or uniform light. Frictional electricity will give a succession of flashes intensely vivid, and might be used for the purpose, but for the fact that the slightest moisture is sufficient to convey the whole charge to the earth. The various forms of galvanic battery are all capable of producing a steady and intense light; but still (besides the great expense) they are not applicable, because of the necessarily varying current, which becomes weaker and weaker as the solution becomes saturated. The magneto-electric machine is then the source from which one would naturally expect a light which should be invariable in its nature, and capable of being continuous for any given time, as the current produced by this machine is constant as long as the helices revolve with the same speed, and the speed can be easily regulated to any required velocity.

The electricity derived from a magneto-machine is induced in coils of wire, by the changing of the magnetic polarity of pieces of soft iron inclosed within the coils or helices; and the quantity or intensity of the induced current depends, first, on the amount of magnetism induced in the soft iron; secondly, on the facility with which the poles of the magnetized soft iron can be reversed; thirdly, on the velocity with which the change of polarity takes place; fourthly, on the length and diameter of the wire forming the helices.

The amount of magnetism induced in the soft iron depends on the size and force of the steel magnets employed, and on the weight and softness of the iron in the helices; but the weight in practice of the soft iron is limited by the weight of the steel magnets, for, if too heavy, the steel magnets will be slowly deprived of their magnetism. To facilitate the change of the poles the soft iron cores of the helices are not solid pieces of iron, but are tubes, single, double, or treble, as it is found by experiment that the same weight of iron, when divided in this manner, loses or takes magnetism in much less time than when in a solid form.

There is a limit to the velocity to be employed when the maximum of electricity is required, for this reason. It has been already remarked that the amount of electricity depends on the amount of magnetism taken up, and that the soft iron takes time to become saturated, as it may be termed, with magnetism; hence, if the velocity be too great with which the cores move from one pole of a magnet to another, there will not be sufficient time for the cores to become saturated. But as again the quantity of electicity increases as the velocity increases, it is necessary to ascertain this maximum point exactly, which is easily done, either by experiment or calculation, based on certain data. The length and diameter of the wire require to be different, according to the current required; for a short thick wire forming the helices represents a galvanic battery composed of a dozen, say, of very large pairs of plates, whilst a long, thin wire would represent a battery composed of thousands of small plates. In other words, supposing the size of the helices to remain the same, if they are composed of thick short wires, quantity is obtained; but if composed of long thin wires, intensity will be the result.

From all this it results that there are certain laws known and established, by which a magneto-electric machine can be made to give a current of any given amount of electricity, with any given ratio between its quantity and intensity.

Having seen on what the production of the current depends, the next point to observe is, the peculiar nature of this induced current. It differs essentially from a galvanic current in this, that while the helices are revolving, the direction of the current is reversed as the core of soft iron passes each consecutive pole of the steel magnets.

It now remains to explain how the current generated in the wires of the helices is to be withdrawn from the machine. In the first place, all the helices are connected in two, or four, or more series; and in doing this great care must be observed that the direction of the coil of every alternate helix is in an opposite direction—that is, if one is wound as a right-hand screw, the next should be as a left-hand screw, or, what amounts to the same thing, supposing all wound in the same direction, then the two inner ends of the wires must be joined of, say, numbers one and two, and the two outer ends of the wires of number two and three, and so on through the series; and lastly, the terminals of the series might be soldered into two insulated discs, and then led from the machine by two pieces of metal kept in contact with the outer surfaces of these discs by a slight spring; such an arrangement allows the alternating current to pass from the machine, and such a current will produce a light, but this light has certain disadvantages. It is never white, but always more or less blue or brownish—in fact, it is like the electric light obscured by placing it behind a flame from spirits of wine. It is also extremely injurious to the eyes, both from its colour and tremulousness; I therefore do not use this current, but in its stead I convert this constantly-inverting current into two that flow from the machine in one direction only. This is accomplished thus:—One half of the helices are arranged so as to arrive on the poles of the magnet at the instant that the other half are exactly midway between the poles. Thus there are two distinct currents; and what may be called the dead point—that is, the point when the current inverts in one series—occurs exactly at the time when the other current is at its maximum; so that if now the inverted currents can be again inverted in both of these distinct currents, and that the two now flowing in one direction can be united as one compound current, it is evident that the result will be a current nearly as uniform as that from a galvanic battery, with the advantage of equable continuity. This is done by the two commutators, which consist each of two insulated rings of metal, of such a form at the periphery that two rollers or rubbers change sides from one disc to the other at the same instant that the current is reversed. Then, by combining the two commutators, a compound current is obtained that will produce a constant white light or perform any of the other functions of the galvanic current, and in a more perfect manner, as it is more uniform in its action.

A steady and constant current thus obtained from the magneto-electric machine, is only one part of the problem of producing a constant and steady light; and although the most important part, still it would be perfectly useless without an efficient lamp or regulator. In order to understand this, it is necessary to explain that the carbon points used for producing the light, or for converting a portion of the electric current into light, are consumed, and that the rate of consumption is irregular, owing to the irregularities in the structure of the substance used, which is the kind of graphite deposited in the gas retorts, sawed up into pencils about a quarter of an inch square; but, as the consumption is irregular, no clockwork, with continuous motion, could be employed for the purpose of causing the carbons to approach as consumed, for it must be understood that the steadiness of the light, as well as its brilliancy, depend on the two carbon points being maintained constantly at a certain distance, corresponding to the strength of the electric current.

Many pieces of apparatus, more or less complicated, have been invented from time to time for the purpose of regulating the movements of the carbon electrodes, and many of them I have tried; but none of them, as formerly constructed, could be used in a lighthouse, because they were more or less uncertain in their action, and because the clockwork was too delicate and liable to accident in other hands than those of an electrician. The question, What constitutes a good regulator? must be answered by stating what it must accomplish; and, moreover, it must perform its several functions in the most simple manner. It must, in the first place, maintain the carbons at a given distance, whatever be the variation in the state of consumption, and must also be capable of being adjusted to

* Read before the Society of Arts, on the evening of Wednesday, December 2.

any strength of current; secondly, if by any accident the current should be interrupted, and the light thereby extinguished, the regulator should be capable of relighting at once with full brilliancy—that is, not only must it allow the carbon points to touch to re-establish the current, but must separate them again instantly, or there would be no light. Such a regulator we have here, for its construction is simple, and it performs its different functions in a most perfect manner. Its construction is this:—The upper carbon is attached by a kind of small vice to a bracket, standing out from a tube, which slides freely in a column. The lower carbon is fixed in the end of another tube, exactly under the other carbon. Both of these tubes are put in motion thus: Two cords, passing over pulleys, properly arranged, are wound on one spindle, but in opposite directions. On turning a stud fixed on the end of the spindle, the regulator is wound up—that is, the top bracket is raised, and the lower tube depressed. On removing the hand from the stud, the upper tube would descend, and, being loaded, would cause the lower tube to rise; but to prevent this, while the regulator is out of use, a bolt is pushed in, which prevents any movement in the regulator till it is again withdrawn. The regulator being wound up, the carbons are firmly fixed in their places by tightening the holders, and are then adjusted so as to bring the points in the focal plane by turning a spindle, to which the fixed end of the cord belonging to the lower carbon is attached. So far, the regulator is only a means by which the carbons can mutually approach each other with a certain relative speed, depending on the different diameters of the two parts of the spindle around which the cords are wound. But if the carbon points remain in contact, there will be no light. Some contrivance, then, was necessary to separate the points to the distance, which, by experience, is found to give most light, and to maintain that distance between the points constantly, till the whole of the pair of carbons is consumed. These two operations are accomplished thus:—The fixed end of the cord which works the upper carbon is attached to one end of a lever; the other end of the lever has a piece of soft iron attached to it, over an electric magnet, so that when the bolt is withdrawn, and the carbons run together until they touch (thus allowing the current to pass), this electro-magnet instantly, by the action of the same current, lifts the cord, and with it the upper carbon, to the required distance. But this is not all; for the carbons would again run together, were there not some contrivance to prevent them. To accomplish this, advantage is taken of these two facts—first, that the quantity of electricity is proportional inversely to the distance between the carbon points; secondly, that the strength of an electro-magnet is proportional to the quantity of electricity passing through the wire that surrounds it. Bearing these two facts in mind, it will be easy to understand the use of the second electro-magnet. Over this electro-magnet, at a small distance above it, is placed a lever, one end of which is drawn down by a spring, the strength of which can be regulated by a thumb-screw. The fulcrum is between this end and the centre. The other end of the lever is furnished with a catch, and immediately over the electro-magnet a piece of soft iron is fixed in the lever. On the carbons being allowed to touch as before, not only are they separated by the means described, but this second lever, acted on by its electro-magnet at the same instant, is drawn down towards it, and thus brings the catch between the teeth of a wheel placed under it for the purpose, and effectually locks the regulator. The strength of the spring is now adjusted till its tendency to lift the catch out exactly balances the current which draws it down. Should the distance now increase but the one-two-hundredth of an inch, the spring will be stronger than the current, will lift the catch, and the carbons will approach; but by doing so more current passes, the electro-magnet is strengthened, and is again enabled to overcome the spring and draw down the catch, and thus by their mutual action the distance between the carbon points is all but invariable.

When these regulators are employed in a lighthouse there are a pair for each lens and two small lenses, so that although it may take ten minutes to replace the consumed carbons, still the light is never extinguished; for, suppose the carbons consumed in the lens No. 1, the regulator is ready in lens No. 2; and all the light-keeper has to do is to bolt the No. 1 regulator and draw the bolt of the regulator in No. 2 lens; the current is thus diverted, No. 2 is instantly lighted, and the lighting of this extinguish[illegible] No. 1.

(To be continued.)

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—J. N.—J. W.—J. H. T.—T. M.—W. W.—J. R.—G. R.—J. M. G.—W. L.—C. H.—Captain B.

S. P.—If the kind of turbine to which you refer, or indeed any other, is locked fast, so that it cannot revolve, the water will pass through it, just as it will overflow the buckets of an overshot water-wheel under similar circumstances; but it will exert a force or pressure on the vanes, tending to put them in motion. We must refer you to our advertising columns for the further information which you require, as we know nothing accurately of the very small turbines of which you speak.

George Beake (St. Leonards).—Your invention might be found useful under certain circumstances.

T. S. (Wolverhampton).—Apply to the Board of Trade. The protection is similar to that given by a patent—that is to say, it enables you to prosecute any one employing the same device for an infringement of your rights—that is all. As to the cost, we cannot give you accurate information—we believe the sum is about £5.

J. Monteih (Dalkeith).—You certainly labour under a singular error. Although an account, as you state, of a new material for tanning has appeared in our paper, there is no earthly reason that we should sell it, or be able to afford you any information as to its price in consequence.

Correspondence.

NARROW GAUGE LOCOMOTIVES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I have read in your publication of the 27th November, an account of a narrow-guage locomotive engine, made by Mr. G. England, of Hatcham Iron Works, New Cross, for the Festiniog Railway Company, now working upon their railway between Festiniog and Port Madoc; and as I happen to know something of the history of those engines, I beg to correct an important error in one part of the leading feature of your article upon that subject.

There, it is stated, that the invariable answer of several engineers of eminence, who were consulted from time to time as to the possibility of employing locomotive power on so narrow a guage as 2 ft., was, that it was impossible. This, I am aware, is correct; but the portion that I consider incorrect, is—"that it has at last been carried out by a young engineer named Holland, who, it is said, furnished the company with plans of the engines, which plans were submitted by the directors to qualified persons, and having been by them deemed feasible, they were placed in the hands of Mr. England for realization."

During the last Session of Parliament, a bill was applied for for powers to construct a railway nearly parallel with the Festiniog Railway, which was, at that time, and had been for many years, worked by horses; and the principal reason for the new company applying for their bill was, that they intended to introduce the locomotive into that district, their line being intended to be 4 ft. 8½ in. gauge, while the existing Festiniog Railway was only 2 ft. gauge, which, they endeavoured to show, might be well enough for working with horse-power, but was utterly incapable of being worked by locomotive power, quoting the opinion of various engineers to that effect.

I heard Mr. England give evidence before the Committee of the House of Lords on the 6th of May (Lord Stanley in the chair), when he stated he was then constructing locomotive engines for the Festiniog Railway Company, who were then opposing the scheme. Their strong point of opposition was, that they intended to work their line with locomotive power, which, although their line was only 2 ft. gauge, they felt assured would be of sufficient power to supply the requirements of the district; and with a view of satisfying the Committee upon that point, they had called Mr. England to give evidence, who stated that he had been entrusted with the construction of the engines by the company, and assured the Committee that they would not only do their work well, in proportion to their weight, but would be equally safe in going round the sharp curves at the intended speed they were to run, as any locomotive at present in work.

He further stated that the centre of gravity was precisely the same as that of a number of engines he had recently made for the Great Western Railway Company, which were then running daily, at the rate of 50 miles an hour, and that the small engines would be absolutely safer on the narrow guage at the speed they required to run (namely, six miles an hour) in going round the sharp curves, than the larger engines were, at the rate of 50 miles an hour.

In cross-examination, Mr. England was asked by the counsel for the intended line, "having evidently been well crammed with opinions of various engineers, which he no doubt believed," if he really thought they would work? When Mr. England cut the matter short by stating emphatically that he would stake his existence upon it.

They then attempted to show that the engines which were then being constructed by Mr. England, had been designed by an inexperienced engineer, a mere youth, having evidently got some information of the part that Mr. Holland had taken in the matter. Mr. England replied, that the young engineer had nothing whatever to do with the design of the engines, but that he (Mr. England) alone was responsibe to the Company, both for the design and construction of the engines. He had contracted to make the engines for the Company, under a guarantee that they should work trains weighing 25 tons up their line, with gradients of 1 in 70, at a speed of six miles an hour; and he felt quite confident of the result.

Mr. England having satisfied the Committee on these matters, the result was, that the bill for the competing line was thrown out.

I was present and heard the evidence, which may be found in the Minutes of the Committee of the House of Lords.

It is certainly gratifying to find that the assertions of Mr. England have been more than realized, as I learn that the engines are daily working upon the line between Festiniog and Port Madoc, and taking a load of 50 tons up these inclines, at a speed of 12 miles an hour, being just double the weight and double the speed that he had contracted for; and he is at present constructing, at his extensive works, New Cross, two more engines precisely of the same dimensions, and from the same drawings, for the same Company, which I doubt not he will be very glad to show to any one interested in these matters.

I remain, Sir, yours very truly,
John Braithwaite, C.E.

Sir,—Our attention has just been directed to a paragraph in your Magazine for Nov. 27th, giving an account of some small locomotive engines recently set to work on a railway of 2 ft. gauge, extending, from the Festiniog slate quarries, a distance of 13 miles, to Port Madoc, in Carnarvonshire.

After stating that several eminent engineers, including the late Robert Stephenson, had been consulted and pronounced against the practicability of working this line by locomotives, you proceed to say that a "young gentleman," Charles Mendez Holland by name, had successfully carried out what Stephenson had expressed his inability to perform.

On October 28th, 1862, we were invited to tender for these little engines. A tracing and specification were supplied; and we are not the least surprised to find that they were the production of . "young gentleman, 21 years of age."

Now, the construction of *small* locomotives for narrow gauges and special purposes has been our *particular study and occupation* for several years past; and it so happened that, in the ordinary course of business (and not as a great feat), we had previously designed an engine for a gauge of

1 ft. 11 in. (the Festiniog gauge being 1 ft. 11½ in.); a modification of this design and specification, accompanied by a diagram showing that the centre of gravity was more favourably placed than in the Great Northern express passenger engines running at 45 miles per hour; and that, therefore, the little engine would be perfectly safe at 8 miles per hour—we say this design and specification were submitted to Mr. Spooner, the resident manager at PortMadoc, and admitted by him to be far superior to those of the "young gentleman." Indeed, so satisfied was Mr. Spooner, that he proposed to lay the plan before his directors, and on November 20th, in reply to an inquiry, wrote us, "I think, in all probability, the Company will adopt *your* plan of locomotive for the Festiniog Railway; but you will hear from me again on the subject." The next news we have is what we read in your MAGAZINE of November 27.

On the Festiniog line the ruling gradient is 1 in 92, and the steepest 1 in 75. We have engines daily working on inclines of 1 in 30 and 1 in 32; and Mr. Ramsbotham has long had an engine of 18 in. gauge running about the works at Crewe. Now it follows either that the Festiniog Slate Company did not adopt the one which their manager admitted to be the *best* design; or, if they did, then that design is *ours*, and has been handed over to another firm to carry out. Which is the more likely alternative, we leave with the public and yourself to decide. At any rate, one thing is quite clear, that it required no great effort of genius to design a locomotive to work on a 2 ft. gauge upon an incline of 1 in 75, and that Mr. Charles Mendez Holland is not the *only*, not even the *first*, man in Great Britain who has designed such an engine.

We are, your obedient servants.
MANNING, WARDLE, & Co.

Boyne Engine Works, Leeds,
December 8, 1863.

[We beg to remind our correspondents that the notice in question has appeared in other papers as well as the MECHANICS' MAGAZINE; and although we inserted it as an example of one of the narrowest locomotives in the world, we in no way identify ourselves with the sentiments and opinions expressed by the writer.—ED. M. M.]

Meetings for the Week.

MON.—*Royal Geographical Soc.*, 1, "On the Formosa," by Robert Sevenhoe, Esq. 2, "Journey from Nazareth to Bozrah, Moab, and Damascus," by F. A. Eaton, Esq., at 8.30 p.m.
London Inst., "On British Art, Past and Present, and in its Social Influences," by Jas. Dafforne, Esq., at 7 p.m.
Medical at 8.30 p.m.
British Architects, at 8 p.m.
TUES.—*Inst. Civil Engineers*, Annual General Meeting, at 8 p.m.
WED.—*Soc. of Arts*, "On the Economic Value of Foods, having special reference to the Dietary of the Labouring Classes," by Dr. Edward Smith, F.R.S., at 8 p.m.
Geological Soc., 1, "Experimental Researches on the Granites of Ireland—Part IV., On the Granites and Syenites of Donegal, &c.," by the Rev. Prof. S. Haughton, M.A. 2, "Recent Discoveries of Fossil Reptiles in Central India," by the late Rev. S. Hislop. 3, "The Recent Earthquake at Manilla," by J. W. Farren, Esq. Communicated by Sir R. I. Murchison, K.C.B. 4, "On the Pebble-bed of Budleigh Salterton," by W. Vicary., Esq., F.G.S. With Notes on the Fossils, by J. W. Salter, Esq., F.G.S.
London Inst., Conversazione.
THUR.—*Linnean*, at 8 p.m.
Chemical, at 8 p.m.
Royal Inst., at 8.30 p.m.
Antiquaries, at 8 p.m.
FRI.—*Achitectural Assoc.*, Class of Design—Gothic Dome.

Miscellanea.

A prospectus has been issued of the General Floating Dock Company, for the construction of floating docks, chiefly in France, but also elsewhere, upon a principle invented by M. Couran. The first operations are to be at the port of Bordeaux.

On the 28th ult., the "Iowa" screw steamship was launched from the building yard of the Neptune Iron Works at Waterford. Her dimensions are—length, 330 ft.; breadth, 35 ft.; depth, 27 ft.; burthen, over 3,500 tons. The "Iowa" is the property of that enterprising firm, Messrs. Malcolmson Bros., Waterford, and the well-known enterprising A. G. Robinson and Co., Mark-lane, London, and intended for the Havre and New York line. She is fitted with all the modern scientific and mechanical appliances—superheaters, waterheaters, condensers, steam winches and cranes, Horn's patent valves and steering apparatus, also Suffield's engine-room telegraphs; and in her construction no expense has been spared to render her complete for her station. This splendid ship was designed by Mr. Horn, the manager of the works, and is the twentieth steamship he has added to their extensive fleet.

Gen. D. C. McCallum, formerly Superintendent of the Erie Railroad, is now the United States Government Engineer of Railways. Lately there was accomplished under his direction, a feat without a parallel in railroad construction. The 30 miles of railroad recently destroyed by Lee's army, was rebuilt; and, in doing so, the ties were prepared, and the main track and switches laid, 600 ft. of bridging (some of which was 60 ft. in height), 20 culverts, and 10 water tanks constructed, all within the space of three weeks!

The Festiniog Railway, in North Wales, a line 14 miles long, with a uniform inclination of 1 in 80, and a gauge of only 2 ft. was opened recently for traffic with locomotive power. The engines, which only weigh 5 tons, are the smallest ever made for railway traffic. They are beautiful, low-built, compact four-wheeled coupled tank engines, with cylinders 8 in. in diameter, and wheels 2 ft. in diameter. At the opening of the Festiniog Railway each engine conveyed a train of about 30 tons weight up the line and round curves of 130 ft. radius at a speed of 13 miles per hour with perfect ease.

A passage is said to have been just discovered near the city of San Fernando peculiarly fitted for a railway, which, by means of the Santiago line, would establish a direct communication between Chili and the Argentine Republic. The Chilian Government have directed a staff of engineers to examine the route.

The public lamp-posts at Paris, which are of cast iron, are being coated with copper, by electro-depositing, so as to have all the effect of bronze. The large fountains in the Place de la Concorde have recently been taken to pieces in order to be thus covered. The work is done by M. Oudry, at Auteuil, who is carrying on electro-depositing on a gigantic scale. He has recently completed a full-sized copy in copper deposit of Trajan's Column at Rome.

It is worthy of remark, in designing screw propellers, that those wheels which have a medium proportionate diameter, a medium pitch and proportionate fraction of the pitch in surface, or in length of the hub, give better results than extreme diameters, very quick pitches, and large working or superficial area on the blades. Experiments, carefully conducted, prove the truth of these statements.

The United States iron-clad steamer "Winnebago" left St. Louis on the 20th October, on a trial trip, under the command of Chief Engineer James W. King, U.S.N., Superintendent of Iron-clads in the West. She was operated on 72 consecutive hours, the engines making 67 revolutions per minute, and the propellers 112 revolutions. With this speed of screw, the vessel sailed 9 miles an hour in smooth water. The "Winnebago" is the first of four sister propellers launched, and considerable anxiety was therfore manifested in the result. It is gratifying to know that everything worked satisfactorily. The vessel is of iron, 220 ft. long, 56 ft. wide, and 7 ft. deep. She has two fore-and-aft bulkheads and six thwart-ship bulkheads, all water-tight. She has two turrets, one Ericsson's and the other Ead's patent. The latter turret differs from Ericsson's, among other things, in having a portion of the shell entered down to, and the whole weight of the turret resting on spheres at the bottom of the vessel. The guns are placed on a huge platform, loaded in the hold, and raised in the turret by steam power. They are also run out by steam; the recoil is received on steam cylinders, and the whole apparatus, guns and all, is operated by one man (an engineer), no other person being needed in the turret. The loading is accomplished by loaders below the turret, in the hold.

Mr. Maclise is making steady progress with his great water-glass picture in the Royal Gallery, Houses of Parliament. An immense quantity and a vast variety of detail occur in the background of such a subject as "The Death of Nelson;" rigging, masts, sails, implements of naval war, and a host of minor figures appear there. Nearly all the still-life accessories, some minor figures, and even two or three large ones, are completed

The name of Azulene has been given by Mr. Septimus Piesse to a new body discovered by him to exist in several essential oils. In a Paper describing Azulene, read before the Chemical Society, the author stated that though this substance was first observed by him as a product derived from the fractional distillation of otto of patchouly, he has since found it to exist generally in essential oils, as an integral part of their proximate constitution, giving the colour by which each oil is distinguished. Pure azulene is of a beautiful blue colour, and the presence of a small quantity of it gives the blue oil of camomile its azure tint; hence the name given to the new body. It is now ascertained that brown-green, yellow-green, and green oils owe their colour to a portion of azulene and a yellow resin, varying in proportions, as optically indicated. We cannot, however, view the general presence of azulene in essential oils merely as a colouring matter, but think it must also have some connection with odorous bodies. Sir D. Brewster is now engaged in examining the optical properties of azulene, which are of a remarkable character. He has already announced that it absorbs entirely several well-known lines in the spectrum.

One of the most frequent causes of the bad burning of mineral oil lamps, says the *Grocer*, arises from the employment of damp wicks. Cotton, like most other vegetable fabrics, readily absorbs from one-sixth to one-fifth of its weight of moisture from the atmosphere; this prevents the free ascent of the oil, and leads to charring of the wick, and the production of an imperfect flame; hence it is exceedingly important that a new wick should be thoroughly dried before it is placed in the lamp. When it has once been saturated with oil, the further absorption of moisture is prevented. If our subscribers would point out this small precaution to their customers, both parties would find it of advantage. The trouble of holding a wick before the fire until it ceases to give out any vapour is so trifling as not to be taken into consideration, and the improvement in the flame and the regularity of burning is considerable.

Special postage stamps, says the *Presse*, are about to be issued in Egypt for franking letters in the interior of the country. They are to be manufactured in England by a company which supplies such articles to many of the States of Europe.

The *Montrose Standard* understands that arrangements are making with the Ordnance authorities for the purpose of testing a projectile of a peculiar construction, which has been invented by Mr. James Cobb, police constable, Lintrathen.

A monument, consisting of a column, about 30 ft. high, with suitable inscription at the base, has been erected in Darfield Churchyard, in memory of the 189 persons who lost their lives in the Lundhill colliery explosion in 1857.

Cotton-growing is occupying attention nearly everywhere on the River Plate, and we are promised great things in the course of a few years. The Cotton Supply Association of Manchester has sent out 20 bags of cotton seed for distribution, and several cotton-growing companies have been established in Corrientes, under the auspices of the governor of that province. The Estancieros in other parts of the Argentine Republic have also sown cotton seed with the most hopeful prospects; and in Paraguay the same spirit is beginning to animate the native population. The *Buenos Ayres Standard*, which may justly claim great credit for the energy with which it has promoted the cultivation of cotton in the River Plate, in its European summary refers to the subject as follows:—"Our foreign readers who take an interest in Argentine prosperity will be pleased to know that over three tons of the very best cotton seed of all descriptions have been distributed, and are already planted in the parts of this nation most adapted to the growth of cotton. Our philantrophic and sterling friends in Manchester will hear with delight that millions and millions of cotton plants are at present overground. We promise the English manufacturers 5,000 bales of cotton from the River Plate this season, and 100,000 the next. In payment for our cotton bales we ask neither gold sovereigns, nor ounces, but railway iron, cotton goods, coal &c. There are some who laugh at our predictions; but we will not 'bate one jot.' In a year or two, if we have peace, the River Plate will be to England what the once prosperous United States of North America were—the supplier of staples, the consumers of manufactures. We are all here as yet in our infancy; our future is great; and England is regarded as the best friend of the Argentine nation."

Mr. Mechi, of Tiptree Hall, writes thus to the *Bedford Times*:—With reference to the filthy and dangerous condition of railway cattle, sheep, and pig trucks, let me suggest an easy and uncostly way of cleansing them. A gutta-percha hose and

jet attached to a 6-in. force pump driven by steam power, would effectually cleanse a truck in two or three minutes. I speak practically in this matter, for my own jet worked by steam is of a thousand scrubbing-brush power. Every crack and cranny is almost instantaneously cleansed. Merely drawing it hastily across a hard gravel walk will cut a furrow in it, and I could, when I fed 350 pigs or beasts, wash them all clean in ten minutes within a range of 40 or 50 ft. One of our steam fire engines gives an exact illustration of the operation I desribe. Railway Companies have generally plenty of water and steam power to propel it. The health of our stock is of vast importance, and it becomes a duty due to the public. In fact, legally, I apprehend that if it could be shown that our animals became diseased by railway neglect, we could not fail to recover damages. The jet would answer equally for steam vessels used in conveying stock.

The French telegraph screw-steamer, "Le Dix Decembre," is now lying in the Thames, opposite the factory of Messrs. Siemens, Halske, and Co., at Charlton, taking in the 130 knots of submarine wire destined to connect the Spanish town, Carthagena, with Oran, on the north-west of Africa. The cable is of an entirely novel construction, being protected on the outside by strips of copper, instead of iron wires, as hitherto. It has been manufactured for the French Government by Messrs. Siemens, Halske, and Co., the celebrated telegraph contractors.

Vegetable ivory, in contact with concentrated sulphuric acid, takes a splendid red colour, almost equal to magenta. At first it is pink, the bright red becoming deeper, and attaining a purple when the acid has been allowed to act for twelve hours. Vegetable ivory dust can in this way be readily distinguished from bone and ivory filings. The change is owing to the action of this acid upon albuminous substances in the presence of sugar, and this reaction has been applied by Raspail in microscopic researches. The white portion of cocoa-nut is similarly affected. The red colours disappear in water like the fine reddish-brown colour produced by mixing essence of turpentine with sulphuric acid.

We learn that a proposal has been set on foot, for a Rifle Conference, to be held in the Hall of King's College, London, on Tuesday, Wednesday, and Thursday, January 12th, 13th, and 14th, 1864. The object of this conference is to enable those who are interested in rifle shooting, to consider the management of rifle matches, prize meetings, and other competitions; to impart information as to the apparatus and weapons employed; the targets, marking, and scoring; and the various adjuncts of rifle shooting; as well as to discuss the arrangements and regulations which have been approved by experience, or are suggested as further improvements.

Some interesting experiments have just been made at the Ministry of the Interior in the telegraph offices. The system of typo-telegraphy, invented by Chevalier Bonelli, was tried on the line between Paris and Boulogne-sur-Mer. The results were very satisfactory. In spite of the bad state of the line and wet weather, the impression of the despatches left nothing to desire, either in regard to the good formation of the letters or the rapidity of transmission. By this new system, three hundred despatches per hour may be printed in duplicate, and at very great distances. There is little doubt that it will be adopted all over the Continent.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

1087. J. Wibberley. *Improvements in machinery or apparatus for winding cotton, silk, wool, or other threads on spools or reels.* Dated April 30, 1863.

In carrying out this invention, the patentee employs the ordinary right and left-handed screws for traversing the thread from end to end of the spool or reel; but instead of changing the traverse by hand, he arranges it by means of self-acting movements. On the ordinary sliding shaft which carries the right and left-handed nuts, he places an arm extending to the top of the machine, and passing through a sliding box working on a plate, which box carries at each side a slide, having connected to it a catch, and the two catches alternately seize and hold the upper part of the arm and maintain the nut upon the screws, the arm being moved alternately from one screw to the other, and also from one catch to the other, by causing it to be acted upon by inclines or cams placed under the plate which carries the sliding box. The two slides on the sliding box are acted upon by a rod connected to the upper part of the guide stock, and the rod which carries the stock works in a bearing fixed to the ordinary sliding shaft, so that a slight revolving motion may be given to the stock alternately in different directions each time the guide comes in contact with the ends of the spool or reel. This revolving motion of the stock places the guide in an angular position adapted to right or left traverse of the thread, and also gives movement to the slides on the sliding box, and relieves the catches alternately from the top of the arm on the sliding shaft, in order to allow one or other of the nuts to be in action. He also employs a lever, put in motion by self-acting means for shifting the driving strap from a fast to a loose pulley on the driving spindle when the desired number of layers have been wound on the spool or reel. The lever is fixed to a stop or setting-on rod carrying a strap fork, and acted upon by a spring, and one end of the lever is held in a detent when the strap is on the fast pulley. On the sliding box there is a ratchet wheel and measuring plate carrying a lifter for raising the lever out of its detent, and allowing the spring to shift the rod and strap fork and stop the machine. *Patent completed.*

1088. A. H. Remond. *An improved process for retaining the aroma of coffee and cocoa.* Dated April 30, 1863.

The nature of this invention consists in giving to the coffee berries and cocoa nibs during the roasting operation a coating of such a material as will fill up the pores of the berry and prevent the escape of any aroma whatever therefrom, but at the same time will impart no disagreeable flavour thereto. The agents preferred are a white sugar, and a thin mucilage of gum or gelatine, either in conjunction or separately. *Patent abandoned.*

1089. W. Clark. *Improvements in the manufacture of hydrocyanide of ammonia and of alkaline and earthy cyanides.* (A communication.) Dated April 30, 1863.

The patentee claims—1, the reaction, at a red heat, of ammoniacal gas on soot or lamp-black, or, preferably, carburetted hydrogens, or other matters producing at a high temperature carbon in a nascent state; 2, the production of hydrocyanide of ammonia and its transformation into cyanide with a base of lime, potash, soda, or of metallic oxide; 3, the simultaneous passage of the ammonia, carburetted hydrogen, or napthaline, over a mixture of charcoal and alkaline carbonate heated to redness, as described; lastly, the method of producing the carbon necessary for the formation of the cyanogen in a nascent state, and in intimate mixture with the ammonia, by the decomposition of a hydrocarburet or other matter capable of producing the carburetted vapours. *Patent completed.*

1090. E. Mitchell. *Improvements in reaping and mowing machines.* Dated April 30, 1863.

This invention consists in the employment of horizontal knives (with three or more blades) or cutters, with or without serrated edges. These knives or cutters are fixed one on each side of the machine, and upon the same level and close to the ground. They are made to travel in opposite directions, motion being given to the said knives or cutters from the driving wheels by means of suitable gearing, such as pulleys and straps or bands, spur or bevel wheels, or frictional gearing. Each knife or cutter has a separate motion with an apparatus to disconnect it from the driving wheel. In advance of the machine, and in front of each knife or cutter, is fixed a wheel, so arranged that it will raise or depress the said knife or cutter, and keep it clear of all obstacles or irregularities of the ground. *Patent abandoned.*

1091. E. G. Brewer. *Improvements in welding and rolling metals and in machinery connected therewith.* (A communication.) Dated April 30, 1863.

This invention consists in welding bars of iron or steel, as hereafter described, so as to form bars of iron or steel of large dimensions perfectly homogeneous. For this purpose the cylinders of the rolling mill are corrugated, or fitted on their external circumference with projections which compress the longitudinal joints of the bars forming the mass, and force them to become welded one with other, when the mass heated to a convenient temperature is passed between the said cylinders. In order to keep the mass laterally at the time the pressure is applied to produce the welding, the rolling mill is provided with rollers set vertically, and on the sides laterally and tangent with the end of the said rolling cylinders. These vertical rollers are intended to keep the metal on the side, and to prevent it from escaping laterally under the effect of the strong pressure it receives while passing between the cylinders; the bars are by this means welded one to the other in every direction, and a homogeneous mass is obtained. *Patent completed.*

1092. C. P. Stewart and J. Kershaw. *Improvements in engines, machinery, and apparatus for containing compressed air, and for applying the power thereof in propelling railway and other carriages.* Dated April 30, 1863.

This invention relates—1, to engines and machinery or apparatus for compressing air, and consists in a combination and arrangement of machinery or apparatus by which air is compressed by the action of water or other liquid having a reciprocating motion imparted to it by a piston or plunger actuated by a piston or pistons worked by steam or other motive power. One feature of the improvements consists in applying the power of the steam or other motive engine so that, when the piston or plunger actuating the water is at one end of its stroke, the piston of the steam or other motive engine will be about mid-stroke. By this means the piston of the steam or other motive engine will be at its greatest speed or power when the piston compressing the air is at its slowest speed, and has the greatest resistance to overcome. Another feature of the invention consists in compressing air at several operations by means of water actuated by steam or other motive engine, that is, in compressing the air in the cylinder, then transferring it to another cylinder of smaller area, where it is further compressed, and so on till it has attained the pressure required. *Patent completed.*

1093. J. Appleby. *Improvements in propelling ships and barges.* Dated April 30, 1863.

This invention relates to a peculiar arrangement of propellers for ships and barges, and consists in the application and use for that purpose of two or more screw propellers or helices, having their respective blades placed at opposite or reversed angles, such propellers being carried on two or more separate shafts, one or more of which are placed at each side of the vessel, and at right angles to the keel; or two or more may be placed on each side of the stern-post or midship. A sufficient space or opening is left between each set of helices or screws to allow the dead water to escape, the propellers acting not as screws but as paddles. By this arrangement the loss of power from back water is obviated, and the speed of the vessel will much depend upon the rapidity with which the screws are worked, thus overcoming a difficulty always met with in the ordinary paddle wheels now in use. *Patent completed.*

1094. J. H. Johnson. *Improvements in rotary engines.* Dated April 30, 1863.

This invention relates to the general arrangement of that class of rotary engines wherein two discs set at an angle opposite to each other are rotated by the direct action of cylinders and pistons upon their inner faces, and consists, according to one arrangement, in connecting the centres of the two inclined discs by a shaft and universal or ball joints, whereby the discs will work in concert without the intervention of toothed gearing upon their peripheries working in corresponding toothed wheels on a second motion shaft, which arrangement may be used if desired; but when employed it is requisite, in order to obtain the best action of the gearing, that the angle of the teeth be not less than 36 deg., nor more than 45 deg. *Patent abandoned.*

1095. J. F. Gray. *Portable apparatus or instruments for rivetting, caulking, chipping, and otherwise operating upon and treating vessels and other substances.* Dated May 1, 1863.

In machines constructed according to this invention, the hammer head or striking part is fitted in the cylinder so as to form a loose end thereof, or an end not rigidly connected therewith, and it is not connected to the piston. The piston is itself an independent bolt or hammer of suitable weight traversing back and forth shuttle-like in the cylinder, and communicating its force to the hammer head by impact within the cylinder. By this arrangement the hammer head is almost stationary, and therefore the length of the machine is much reduced, and the hammer head can be kept in contact with the material to be operated upon, which is an advantage in certain kinds of work. This loose end of the cylinder may be either a hammer head or "tool head" or "tool holder," or a "swage," or other tool, and will be hereinafter referred to under the name of "tool." The invention consists—2, in providing improved modes whereby the slide valves of impact machines when applied to the purpose hereinbefore referred to may be operated self-actingly at each stroke of the piston. These modes consist—1, in an arrangement of inside tappets; 2, in an arrangement whereby the slide valve is moved in one direction by an inside tappet, and in the other direction by the direct action of steam and piston connected with or forming a part of the slide valve; 3, in an arrangement whereby the slide valve is moved in both directions by the direct action of steam upon pistons connected with or forming parts of the slide valves, or communicating motion thereto; also in adapting such impact machines to the operations of rivetting required in the construction of iron ships, bridges, and other uses, by fitting them with suitable contrivances for attaching, disconnecting, and holding up, so as to constitute efficient portable rivetting machines; 4, in adapting such impact machines to the operation of chipping, caulking, planishing copper pipes, thinning the edges of copper plates, and in adapting it to be used as a portable steam hammer; 5, in providing a convenient portable boiler and rivet hearth by combining in one apparatus the boiler, the rivet hearth, a furnace common to both, and a feed injector. *Patent completed.*

1096. E. Jones. *Improvements in drainage and in water-closets, and in the means and apparatus necessary for the same respectively.* Dated May 1, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

1097. W. Clissold. *Improved apparatus for fulling woollen cloths and washing and cleansing woven fabrics.* Dated May 1, 1863.

This invention relates to the application to machines employed in fulling cloth and washing and cleansing lengths or bands of woven fabrics of a certain mechanical means for imparting a temporary twist to the fabric under treatment immediately before it enters the fulling or pressing rolls, the object (when fulling cloth) being to prevent the permanent formation of creases during the fulling operation. *Patent completed.*

1098. W. G. CRAIG. *Improvements in feed apparatus for steam boilers.* (A communication.) Dated May 1, 1863.

This invention consists in certain improvements upon the feed apparatus known as Giffard's injector. The invention is not described apart from the drawings. *Patent completed.*

1099. J. BADARD. *Improvements in the preparation of rape seed, cake, linseed cake, poppy-seed cake, niger-seed cake, and ground-nut cake.* Dated May 1, 1863.

In order to avoid liability to damage, the patentee submits these cakes after they come from the press, and when they are in the state in which they are usually sent into the market, to a desiccating or drying process. He places the cakes in frames or racks in a drying chamber at a temperature, by preference, of about 180 deg. Fahr., and he keeps them in this chamber until all or nearly all the moisture which will evaporate from the cakes at this temperature has passed off; about twenty-four hours is a suitable time. The cakes are then taken out of the chamber and packed or stored. This process does not in any way injure the cakes as food for cattle, and will enable them to bear keeping for a considerable time without deterioration. *Patent completed.*

1100. T. L. BISSELL. *An improved apparatus for charging breech-loading cartridges.* Dated May 2, 1863.

This invention relates to an apparatus designed for the purpose of charging and turning over the edge of cartridges or cases such as are used with breech-loading firearms, which apparatus is constructed as follows:—To a frame of suitable form the inventor connects a hollow fixed tube in which the cartridge or case to be charged is placed through an opening formed in the front or side thereof. Inside the upper part of this tube is a second hollow tube capable of sliding vertically therein, to the upper end of which is attached a reservoir which is divided in the centre so as to contain powder in one side and shot in the other. Between the reservoir and the last named tube, and in connection with both, is a chamber (also divided in the centre) having two lever chargers, as used in ordinary shot belts or pouches, to measure the quantity of the charge admitted at a time. To the same frame he also attaches a small vertical spindle capable of being revolved by a winch handle, and carrying a hollow inverted cup for turning over the edge or muzzle of the cartridge case, the case itself being supported at the back by a semi-cylindrical piece fixed to the frame, and resting at the bottom on a moveable socket attached to a lever, by means of which it may be pressed gradually upwards against the revolving cup, by which means the closure of the muzzle of the cartridge case is effected in a much more regular and efficient manner than has heretofore been accomplished. *Patent abandoned.*

1101. W. T. SMITH. *Improvements in washing machines.* Dated May 2, 1863.

This invention consists in the employment in or over a trough, or other vessel, of one or more grooved rollers, to which motion is communicated by a treadle and crank through an endless belt or toothed gear. The person washing works the roller by the foot, while with the hands the clothes or articles to be washed are kept in or pressed in contact with the grooved roller. The projections or parts between the grooves act as beaters, and remove all dirt from the articles, after having been more or less soaped and soaked in water in the usual manner. In some cases the inventor also uses a plain roller, upon which the clothes or other articles rest while being acted upon by the revolving beaters. *Patent abandoned.*

1102. J. W. GIBSON and W. TURNER. *Improvements in springs to be used for railway buffers, draw hooks, and also for carrying springs of railway carriages and other vehicles.* Dated May 2, 1863.

This invention relates to the employment for the above-mentioned purpose of volute springs or bars of steel, or their equivalents, in connection with the certain special arrangements for twisting or winding up such springs or bars of steel, thereby affording the requisite power of resistance. *Patent abandoned.*

1103. G. BURT. *Improvements in machinery for punching, stamping, or forging metals.* Dated May 2, 1863.

This invention consists in the construction of a machine which shall operate as a direct-acting hammer, having the advantages of being able to increase the power of the blow at will, to throw the hammer easily in and out of gear, to raise the hammer when it is either in or out of gear, and to increase or reduce the length of the stroke given by the hammer. *Patent abandoned.*

1104. J. PURDEY. *Improvements in breech-loading fire-arms.* Dated May 2, 1863.

This invention relates to that description of firearms in which the barrel of the gun is made to turn on a horizontal pin, so as to raise and expose the end or breech of the gun, in order that a cartridge may be placed therein. The invention consists of a novel mode of securing or locking the barrel when it is brought down into a horizontal position on the stock ready for being discharged. For this purpose a locking bolt, forming part of a sliding bar working through the body of the action, enters two slots or notches in the steel lump on the under side of the barrels. This locking bolt forms part of a sliding bar which is worked by a lever placed in the middle of the body, and made to fit snugly in or against the trigger guard. A projection on the lever, or the tail or upper end of the lever, works through a slot in the sliding bar, which is kept up to its work by one or more springs acting either at the back of the bolt or against the lever, or both, as may be found most advisable. The bolt that forms part of the sliding bar, and also the end of the steel lump, are both bevelled, so that in the action of closing up the barrels the bolt is first made to move back, and when the barrel is in its place the bolt is by means of the spring made to slide forward and lock the gun securely. *Patent completed.*

1105. S. J. BARTLETT. *Improvements in apparatus for straining and drawing off liquids.* Dated May 2, 1863.

This invention relates to a cheap and simple contrivance to be fitted to tea and coffee urns and other vessels employed in the preparation of infusions and decoctions, also to cisterns, tanks, or vats, whereby the infusion or other liquor to be obtained and drawn off is obtained in a clear state. In applying this invention to an ordinary or other urn intended to be used in the preparation of infusions of tea or coffee, an inverted cup or bell of metal, porcelain, or other suitable material is to be placed near the bottom of the urn with its mouth downwards. To the top of this bell or inverted cup is fitted a syphon pipe curving downwards outside the cup to a little below the mouth thereof, and then entering the ordinary or other draw off tap or cock. A strainer or filter of perforated metal, wire gauze, or other suitable material is placed in the mouth of the cup. In preparing coffee or tea by this improved urn, the coffee or tea is first introduced into the bottom of the urn, and the hot water is then poured in over the bell or cup. The air therein is rarefied and expanded, and escapes in the form of bubbles from under the lower lip, thereby keeping the coffee or tea agitated for a short period, and allowing it to be well saturated by the hot water. So soon as the grounds have settled, the infusion is ready to be drawn off through the tap, the tap pipe and cup or bell forming together a syphon, and the liquid is consequently obliged to rise before it is drawn off, in place of descending, as is the case in most other arrangements where the receptacle is above the vent, and where the heavier particles pass away with the liquid. *Patent completed.*

1106. J. B. DUBREUIL. *Improvements in carts, waggons, and other vehicles.* Dated May 2, 1863.

This invention consists in a method of constructing carts, waggons, and other similar vehicles, whereby they are rendered capable of weighing their contents. *Patent abandoned.*

1107. J. T. and T. OAKLEY. *Improvements in the construction of garden pumps, part of which said improvement is applicable to fire engines and other hydraulic machines.* Dated May 2, 1863.

This invention is carried out as follows:—Within a vessel somewhat similar in form and size to an ordinary pail when inverted, and to the bottom thereof, the patentees adapt a rectangular-shaped wooden box, fitted with a suitable valve or valves, and one or more pump barrels open at top, and fitted with a piston or pistons packed or otherwise, so as to work water-tight inside the barrels. The rods of these pistons are made to work vertically by suitable handles, or they may be connected to a horizontal lever working on a pin or fulcrum in a piece of wood fixed upright in the aforesaid vessel; there is a loose pipe connected to the aforesaid box. The suction is within the aforesaid vessel or attached by a union to the outside of the same. There is also connected to the aforesaid box an air vessel formed of vulcanized india rubber, or other suitable elastic material, which when the pump is in action becomes distended by the compressed air as the water is forced therein, so that in addition to the force of the compressed air in the air vessel the patentees obtain and utilize the elastic force of the distended india-rubber air vessel, which materially increases the power of the pump, secures a velocity of flow, and forces a column of water to a greater height than when the air vessel is made of metal, as heretofore practised in the construction of force pumps. *Patent completed.*

1108. H. MYERS. *A new apparatus for indicating appointments or fixed engagements.* Dated May 2, 1863.

This invention consists in the employment of a circular clock dial, arranged in suitable divisions, and with hands for indicating the appointment or fixed engagement. *Patent abandoned.*

1109. E. R. SOUTHBY. *Improvements in the extraction of scents from plants, flowers, and other odoriferous substances.* Dated May 4, 1863.

In carrying out this invention, the inventor extracts the odoriferous part of plants, flowers, and other scent-yielding substances, by dissolving the same in the light spirit derived from petroleum and other native oils, or from coal shale and other analogous substances by destructive distillation, and commonly known as Ettierine. *Patent abandoned.*

1110. J. FORTUNE. *Improved means of joining or fastening together lace, blond, quilling, or similar materials.* Dated May 4, 1863.

This invention consists in joining or fastening together pieces of lace, blond, &c., by means of gum and a hot iron. *Patent completed.*

1112. B. G. SLOPER. *Improvements in apparatus for separating metals from earthy and other matters mixed with them.* Dated May 4, 1863.

This invention consists in constructing apparatus as hereafter described, wherein the matters acted on are first separated according to their degrees of fineness, and are afterwards subjected to washings, whereby the metals and metallic particles are left in receptacles from which they are afterwards removed. The apparatus consists of a perforated cylinder, the perforations in which are gradually reduced in size from one end of the cylinder to the other. This cylinder is made to revolve over, and partly in, a cistern or vessel containing water, and in which funnels are placed for receiving the matters as they issue through the perforated cylinder. These funnels are fixed into, or form part of, tubes fitted at the bottom with taps which open into syphon pipes of india rubber, or other suitable flexible material. An agitator is placed under the bends of these pipes, and keeps them constantly in motion. *Patent completed.*

1113. G. HASELTINE. *Improvements in springs for railway carriages and other purposes.* (A communication.) Dated May 4, 1863.

This invention relates, chiefly, to the use of longitudinally fluted bars in the construction of spiral or helical springs, to the novel modes of combining india rubber or similar material with metal in the formation of springs for supporting heavy weights or resisting great pressure, to a novel construction of the parts whereby the strength is greatly increased and the weight diminished, and to so arranging the parts as to augment the elasticity of the spring by means of confined air. The required elasticity of the composed spring is obtained by the use of a spiral spring in connection with india rubber or similar material, or by the use of one or more concavo-convex springs and india rubber, or by the employment of india rubber in connection with confined air. *Patent completed.*

1114. F. APPLEGATE. *Improvements in spring balances and pressure gauges.* Dated May 4, 1863.

Instead of using dial and index hands or pointers pointing to the graduations on a disc or other dial plate in these instruments, the inventor makes the dials or indicators of such apparatus of a plain opaque surface covering the graduations of the dial, which are visible through an opening, glazed or otherwise, through which the reading of the gauge is obtained, such opening passing over the graduated dial or surface either of a circular or of a lengthened form, and the indicator (that is, the plate with the opening) either rotating or moving in a direct line as usual. *Patent abandoned.*

1115. J. H. JOHNSON. *Improvements in the manufacture of wrought iron and steel, and in the apparatus to be employed therein.* (A communication.) Dated May 5, 1863.

This invention relates to the manufacture or production in a blast furnace of wrought iron and steel direct from the ore, and consists, essentially, in injecting or blowing into the furnace with the blast finely divided oxide of iron. *Patent completed.*

1116. W. WALSH. *Improvements in obtaining and purifying oxalate of soda, which improvements are also applicable to the manufacture of oxalic acid.* Dated May 5, 1863.

This invention consists in submitting woody fibre or other organic substances to the action of caustic soda alone. The patentees uses caustic soda known as dry or solid caustic soda, containing from 60 to 70 per cent. of caustic alkali, and submits it to a temperature of from 450 deg. to 800 deg. Fahr. in a crucible or cast-iron vessel, so that it can be liquified without admixture of water, and thereby obtain a fluid of the before-mentioned strength. This fluid is removed from the crucible to another vessel, and the woody fibre or other organic substances placed in it, and agitated by hand or machine. On account of the great heat and strength of the caustic soda lixiviation takes place, and forms with the woody fibre a pulp which is a crude oxalate of soda. This pulp is afterwards dried, and contains 20 to 30 per cent, of oxalate, whic his purified and converted into oxalic acid in the ordinary manner. *Patent completed.*

1117. R. G. KENT. *Improvements in the construction and arrangement of shades and reflectors for gas lights.* Dated May 5, 1863.

This invention relates to certain improvements whereby the light obtained from fishtail, batswing, oval, argand, or other gas burners giving a flame of an elongated form, is more perfectly diffused and reflected than by the arrangements hitherto in use. The shades which are constructed in accordance with this invention are of an eliptical form, the material employed being either glass or porcelain, and are used in combination with such burners as before mentioned. The shades are fixed and adjusted by means of suitable fittings. The result of the employment of the shades constructed and employed as before mentioned, is that the rays of light diverging from every portion of the elongated flame are duly transmitted and reflected, and the whole of the illuminating power of the flame is thus made available. The reflectors are also constructed of an elliptical form, and are formed of glass or metal, or combinations of glass and metal, or of any substance or substances possessing the requisite powers of reflection, and the surfaces thereof may be either smooth, cut, or corrugated, so as to reflect the rays of light in any desired direction. The reflectors are placed in any desired position with reference to the flame, and may be used with or without the shade as may be desired. *Patent completed.*

1118. E. CHESSHIRE. *Improvements in apparatus for intercepting the solid portions of the soil of water-closets.* Dated May 5, 1863.

This invention consists in the use of an apparatus consisting of a vessel or reservoir placed or constructed in the course of the soil pipe or drain, passing from the water-closet to the drain or main sewer, the said vessel or reservoir being divided by a perforated pipe, plate, or grating into two compartments, the soil pipe or pipes from the water closet or closets opening into one of the said compartments, and the drain or sewer pipe opening into the other of the said compartments, the said perforated pipe, plate, or grating intercepting the solid portions of the soil, and retaining them in the vessel or reservoir, and permitting the liquid portions to pass through to the drain or sewer pipe. *Patent completed.*

1119. W. BOOTHROYD. *Improvements in stationary engines or apparatus for obtaining motive power.* Dated May 5, 1863.

In carrying out this invention, the inventor employs a cast-iron or other suitable framework, the top of which is provided with four pulleys or wheels for carrying a horizontal or main shaft. On this horizontal or main shaft are fixed two bosses, each boss having four arms, the arms being connected together by four plates or cross bars extending from arm to arm on each boss. On the said horizontal or main shaft he also employs a spur wheel geared into another spur or pinion wheel fixed on a cross or counter shaft. The said cross or counter shaft is provided with a toothed wheel, geared into another toothed wheel for the purpose of giving motion to an eccentric tappet or lever attached to a carriage for pulling and pushing two or more weights on and off the before-named plates or cross bars.

He also employs another shaft with suitable gearing, one end of which receives motion from the toothed wheels on the cross or counter shaft, and the other end by means of another pair of toothed wheels gives motion to two rollers. These rollers are provided with chains or ropes for lifting the weights when pulled off the plates or cross bars into their proper position. These rollers turn in opposite directions by means of three bevel wheels, two of the bevel wheels being loose, so that either one or the other may be put into gear as required. Above the framework he fixes a carriage and tramway with a sheave pulley attached for the purpose of the chains or ropes to work over, the said carriage being moved to and fro by the eccentric tappet or lever. He also employs a break wheel for regulating the speed as may be required. *Patent abandoned.*

1120. R. A. BROOMAN. *A new fabric suitable for trimmings.* (A communication.) Dated May 5, 1863.

This invention consists in manufacturing in pieces or in strips a new fabric, by sewing, stitching, or otherwise applying birds, feathers on a ground of linen, cotton, or other like suitable foundation. The feathers may be of one colour or variegated, and may be made to resemble flowers or other figures, and may be worked into various patterns. *Patent completed.*

1121. F. APPLEGATE. *Improvements in stopping and starting railway trains.* Dated May 5, 1863.

This invention consists in the application of a spring or springs, to be thrown into gear to take up the vis viva of a railway train, which the inventor applies in connection with the wheels of the tender while in motion; at the same time applying a breaking action thereto whereby to stop the train. The spring or springs are by this means wound up in great tension, and are capable of being held in such state of tension and afterwards utilized in overcoming the vis inertiæ of the train in starting. *Patent abandoned.*

1122. P. BRADSHAW. *Improvements in mounting or hanging millstones for grinding grain and other substances.* Dated May 5, 1863.

According to this invention, the patentee makes the centre bar of the runner to carry the pivot, and he causes it to bear on a flat surface on the upper end of the driving spindle; thus it will be seen that the pivot is not confined, as formerly, but can adjust itself accurately to the driving instruments, so that these may be sure to bear equally on each side of the pivot. The pivot might be mounted at the top of the spindle, and the plain surface might be on the centre bar, but this would produce some difficulty in balancing the stone. He prefers to employ, in place of the driving forks before mentioned, lugs or projections on the boss at the top of the driving spindle, and these lugs or projections enter loosely into corresponding recesses in the centre bar. The sides of the lugs or projections he does not make vertical, but to project forward on a level with the plain surface on which the pivot rests, so that the contact for driving the stone, or the bite, as it is termed, may take place only on a level with the pivot, whereby the motion is rendered steadier than it would be if the bite were either above or below the centre. *Patent completed.*

1123. J. H. KNOTT. *Improvements in pumps.* Dated May 5, 1863.

This invention relates to that description of pumps known as rotary pumps. The improved rotary pump consists of a cylinder in which works a piston resembling in form the eccentric gear of a steam engine. The eccentric is mounted on a central spindle, and works in a strap which envelops it. This strap is provided with a tail, which works in a spindle or socket at one end of the cylinder, and thereby forms a stop which divides the cylinder into two compartments, one of which is in communication with the suction pipe, and the other with the exit pipe. It will, of course, be understood that the piston and strap with its tail or stop are made accurately to fit the cylinder, so that when the cylinder head or end plate is secured in its place, the ends of the piston may be water-tight; and, therefore, in communicating rotary motion to the piston shaft, the piston will move in the cylinder and will draw in the water by one pipe and force it out by the other. The spindle through which the tail of the stop passes is fitted water-tight in its socket or bearing, in which it is free to vibrate so as to accommodate itself to the movements of the tail piece. It will be understood that, by this arrangement of parts, all moveable valves may be dispensed with, and that a continuous or nearly continuous suction takes place, and that the pump will act as a force pump as well as a suction pump. *Patent completed.*

1124. W. GLOFER. *Improvements in means or apparatus to facilitate the steering of ships and other vessels.* Dated May 5, 1863.

Upon the axis of the steering wheel the patentee applies another wheel, toothed or otherwise formed to hold the parts of a chain or rope, which is thence guided by suitable pulleys, and has its opposite ends made fast to the circumference of a wheel applied to the rudder head, or to the axis of motion of the rudder. Thus, by acting on the steering wheel, motion is, through the single rope or chain, communicated direct to the rudder. By this means a slack chain is avoided, and the power exerted is more immediately effective. *Patent completed.*

1125. W. C. WILKINS. *Improvements in lamps.* Dated May 5, 1863.

This invention is carried out as follows:—To a lamp constructed with a reservoir in its stem or base to contain the matter to be burned, and means for forcing up such matter for consumption, the patentee applies between such reservoir and the burner a separate small vessel as an intermediate reservoir or receiver for the supply to the wick, and he applies leather or other suitable non-conducting matter between the upper parts of this intermediate reservoir or receiver and the burner tubes. This intermediate reservoir or receiver has an overflow for surplus fluid to flow back into the reservoir below. In some cases he applies several of such tubes concentrically supplied by intermediate reservoirs or receivers, and in order to prevent the conducting of heat to the fluid to be consumed, the wick tubes may be each separated, the upper from the lower parts thereof, except by slight connections, or by the application of non-conducting material between the parts. He also applies an internal hollow cone, and an external tubular deflector, the upper or deflecting edge thereof being turned inwards, and at or near the level of the wick tubes. This external deflector he prefers to be of glass, so as to intercept the rays of light as little as possible; over these he applies an external chimney. He also applies within the main reservoir for the fluid to be burned a pump or working diaphragm, with the crank shaft and wheel-work or other mechanism for forcing up such fluid to the intermediate reservoir and wick or wicks, by which the use of packing is avoided, and simplicity of working is obtained. *Patent completed.*

1126. R. B. COCHRAN. *Improvements in sewing machines, and in apparatus connected therewith.* Dated May 5, 1863.

The patentee claims—1, the general arrangement and combination of mechanism for saving or uniting fabrics, as described; 2, the application and use of a reciprocating shuttle or thread case, driven or actuated in the manner described; 3, the combination with the shuttle and shuttle-actuating mechanism above referred to of a rotating hook and cylinder formed on the end of the driving shaft, as described; 4, the application and use to and in sewing machines of all kinds of two or more tension apparatus, which are permanently adjusted to take certain specified sizes or numbers of thread; 5, the combination with the stitch-regulating mechanism of an indicator and graduated scale for the purpose described; 6, the attaching of the presser foot of a sewing machine to the presser bar by the aid of a slot made either in the bar or in the foot, in combination with a jam nut, whereby it can readily be removed, and another substituted, substantially as described; 7, the peculiar arrangement of apparatus for driving sewing machines, as described and illustrated in the drawings; 8, the peculiar construction of hinges for sewing-machine covers, as described; 9, the constructing of binders for sewing machines in such a manner that they are self-adjusting to any thickness of material, as well as being capable of adjustment to suit different widths of binding, substantially as described. *Patent completed.*

1127. T. SAGAR and J. WILKINSON. *Certain improvements in power looms for weaving.* Dated May 5, 1863.

This invention consists in an improved method of applying the "weft fork" to power looms, whereby the liability of breaking or damaging the prongs of the weft fork is lessened. The slot cut across the lay through which the weft fork traverses does not require to be so large as usual, thereby increasing the strength of the lay at that point, and allowing of wider cloth being woven in the same width of loom. *Patent completed.*

1128. J. T. WARD. *Improvements in carriages.* Dated May 6, 1863.

In carrying out this invention, the inventor makes the body of the carriage of the form of the carriage ordinarily called a "waggonette," the said body of the carriage being provided with moveable raised backs to the seats. He provides a cover for the carriage, which cover being placed upon the body and fixed temporarily thereon, converts it from an open to a close carriage. The said cover has a seat in front, which will accommodate four persons, and is railed round at top so as to fit it to carry luggage. The said cover is provided with windows. As the moveable high backs to the seats are not required when the cover is used with the carriage, the said backs are removed before the cover is put on. The invention consists, secondly, in the addition of a folding or collapsible luggage basket. He names this carriage the "Cawdor." *Patent abandoned.*

1129. W. E. GEDGE. *An improved toy.* (A communication.) Dated May 6, 1863.

This improved toy is composed of a pistol which discharges or launches a top, and of the top itself. There is a small toothed wheel supported on an axle passing in the end of the pistol barrel; a string is rolled round the axle and is attached by the other end to a spring inside the pistol and a small rod (answering to the ramrod of a pistol), one end of which takes into the teeth of the small wheel, the other being attached to the trigger of the pistol. The top itself has a special arrangement; its stem carries a pin which fits into the axle of the small toothed wheel of the pistol, the said axle being hollow, and terminating in a spiral form. *Patent abandoned.*

1130. S. HIBBERT and J. KAY. *Certain improvements in apparatus for cleansing potatoes and in decorticating the same and other esculent roots.* Dated May 6, 1863.

This invention consists in the employment and use of a double arrangement of rotating brushes—one portion thereof being placed upon a central shaft, and rotating in one direction; the other brushes being secured in a perforated cylinder encircling the central shaft, the bristles projecting towards each other, and the cylinder being driven in an opposite direction to the shaft by means of bevel gearing or any other suitable mechanism. The brushes are made to taper towards each other at the lower extremity, so that all sizes of roots will be acted upon, and the potatoes or other roots are placed in the space between the brushes, the action of which cleanses and removes the skin or exterior coating therefrom, the whole being enclosed in a vessel containing water. *Patent completed.*

1131. S. D. MACKELLEN. *Certain improvements in watches and other timekeepers.* Dated May 6, 1863.

This invention relates to that part of watches and timekeepers known as the escapement, and is designed to dispense with the "escapement wheel" as employed in the ordinary "duplex escapements." The invention consists in the use of a horizontal plate or fly, furnished with one, two, or more pointed arms or long teeth, such fly being mounted upon a central vertical shaft carrying a pinion which gears with a toothed wheel, and is driven by the ordinary train of wheels in connection with the finger. These pointed arms or teeth as they revolve take successively into the slot in the balance wheel shaft (which is used in the duplex escapement), and passing out of the slot form the escapement. Upon the fly are secured two or more vertical ruby pins, termed "impulse pins," so arranged that as the escapement takes place they strike a projecting finger on the balance wheel shaft, and give motion and impetus to the balance wheel, and thus a simple description of escapement is constituted. By this means the complicated duplex escape wheel is altogether dispensed with, and the usual ruby roller is rendered unnecessary, as by using the toothed fly the force is diminished so much that the friction on the shaft is very slight. This also permits a wider notch to be cut in the shaft. *Patent completed.*

1132. J. M. SINGER. *Improvements in sewing machines.* Dated May 6, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1133. G. DAVIES. *Improvements in machinery or apparatus for forging and dressing horse-shoe and other nails.* (A communication.) Dated May 6, 1863.

The characteristic feature upon which the present invention is based consists in the operation of four tools placed at right angles, which open and close two at a time, striking in such a manner as to obtain a forging effect analogous to that produced by hand. The tools in working allow of an escape at the side, and it is only necessary to have a special feeding apparatus to the machine so arranged as to supply the necessary amount of iron or material to the tools in order to make the required length. The dressing machine is intended to finish the rods or shanks of the nails, and, at the same time to efface the marks of the tools or hammers, which although they are very slight, are nevertheless perceptible. *Patent completed.*

1134. T. BEESLEY. *Improvements in the construction of boxes or cases for carrying and packing bottles.* Dated May 6, 1863.

According to one arrangement for performing this invention, the inventor takes a case, and near the bottom thereof he fits a frame with as many apertures in it as the case is required bottles to contain. Into these apertures the bottles are placed, their lower ends resting on the bottom of the case, while the frame through which they pass steadies them and prevents their coming in contact with one another. A second frame, containing apertures equal in number, but smaller than those in the lower part of the case, is made to fit the case accurately, and in such manner that the apertures shall pass over the necks of the bottles. The second frame is held in position by thumb screws, or by a handle fitted to its top side, which, when the cover is secured, presses against and so steadies it, while at the same time it acts as a means for readily removing the frame from the case. *Patent abandoned.*

1135. A. STURROCK. *Improvements in locomotive engines and tenders.* Dated May 6, 1863.

This invention consists in fitting auxiliary cylinders and engines on or to the tender, in connecting them through ordinary connecting-rods in the usual manner to the wheels of the tender, in coupling all or some of the wheels of the tender, and in taking steam for the tender cylinders from the ordinary boiler which supplies the engine proper. The invention also consists in forming the water tank in the tender with a false bottom, and in leading the exhaust steam from the tender cylinders into the chamber between the two bottoms. Sometimes, instead of forming the tender with a false bottom, the patentee causes the waste steam to circulate through a coil or series of pipes carried through the water in the tender; this steam heats the water in the tank, and the steam which is condensed in the chamber or pipes returns into the tender and is forced by the pumps into the boiler. *Patent completed.*

1136. C. W. ATKINSON. *An improved steam or other motive power engine.* Dated May 6, 1863.

This invention consists in a certain arrangement whereby the to-and-fro motion of the piston of a steam or other motive power engine is converted into a rotary motion, without the intervention of a crank or other apparatus as ordinarily employed. The arrangement for this purpose consists in bringing pressure to bear alternately on either side of an enlarged head, or on either of two surfaces carried by the piston rod. The rotating shaft which is to receive the converted to-and-fro motion is between such surfaces, and has on either side thereof the apparatus to receive the to-and-fro motion. *Patent abandoned.*

1137. A. V. NEWTON. *Improvements in sewing machines.* (A communication.) Dated May 6, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1138. J. PARK. *Improvements in communicating motion to machinery for manufacturing paper pulp.* Dated May 7, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1139. J. SNIDER. *Improvements in breech-loading fire-arms.* Dated May 7, 1863.

This invention primarily refers to the arrangements for locking and securing the moveable breech piece or charge chamber. The first part of the invention consists in holding and securing the breech piece in place by a self-acting latch bolt centred in such manner that the bolt takes into an aperature provided for its reception so soon as the breech piece is pressed down by the hand. On the discharge of the cam the hammer in falling and striking the nipple comes so near to one end of the lever to which the latch bolt is attached as to prevent the bolt leaving the aperture into which it entered when the breech was closed. The breech is unlocked by pressing a button on the lever in the contrary direction to that in which it was struck by the hammer, and the breech is raised by the hand. The second part of the invention consists in making the fire communication central to the charge chamber. The third part of the invention consists in forming the hinge and breech in one piece, and in making the hole for the hinge pin oval. The fourth part of the invention consists in forming an aperture on the under surface of the breech closed by a screw for the introduction of lubricating material into the valve chamber. *Patent abandoned.*

1140. P. Bourne. *Improvements in miners' lamps.* Dated May 7, 1863.

This invention relates to the lamp known as the "Davy safety lamp," and consists in means for extinguishing the light of the lamp in the act of opening the lamp, and before the wire gauze covering can be removed from the lamp. For this purpose the inventor attaches to the lamp near the wick-holder an apparatus consisting of one or more levers mounted on a suitable fulcrum, bearing or bearings, and which apparatus is capable of being depressed on the wick by the act of removing the wire gauze covering. This apparatus is, by the action of a suitable spring or springs, or by the weight of the short end of the lever or levers aforesaid, or by both of such means, kept out of the way of the ignited wick so long as the gauze covering remains on the lamp, or when the gauze covering is being placed on the lamp; but as soon as any attempt is made to remove the gauze covering, one or more small projecting piece or pieces attached to the mounting of the gauze covering is forced under the short arm of the lever (or of each of the levers if more than one), which short arm is thereby, and by the unscrewing of the gauze covering, elevated, and thus the other end of such lever (or levers) is depressed on the wick, and so the wick is pressed down and the light becomes extinguished. *Patent abandoned.*

1141. J. Walker. *Improvements in the construction of mechanism applicable to looms and carding engines and other machinery.* Dated May 7, 1863.

This invention relates, firstly, to the construction of eccentrics or cranks, their connecting links or rods, and their combination with the driving pulley disc or other mechanism, such mechanism being applicable to looms, and to the doffing motions of carding engines, and to other machinery where eccentric or crank motions are required. The improvements consist in making the connecting links or rods with a slit in them lengthwise from the hole in which the eccentric or crank works, and in placing a screw through the link or rod so as to be able to close or open the slit, and thus tighten or slacken the grasp of the link or rod upon the eccentric or crank. The second part of the invention relates to the taking-up rollers of wrought sheet iron, or in covering them with wrought sheet iron on the surface when rolled cold or hot by being passed through rollers which have roughened surfaces. *Patent abandoned.*

1142. A. Stanley. *Certain improvements in the mode of finishing clasps and other such like metallic connectors, and which said mode of finish is also applicable to other purposes.* Dated May 7, 1863.

This invention consist in finishing metallic clasps and such like connectors by covering them with leather, either on one or both sides, the said leather being moulded, pressed, or embossed to the shape or sectional design of the metal shell or part desired to be covered, and which leather is intended to be united around the edges to the metal portion or part or back covering by stitching or sewing, which may be effected by hand, or with the aid of the sewing machine, or otherwise secured; and in some instances the inventor purposes adding on the outer surface of the leather central or other ornaments, which may be secured by wire shanks soldered or otherwise united to the ornament, and passed through the leather covering metal shell or other material and back covering, when back coverings are used, to be spread over or rivetted or secured in any other convenient way. *Patent abandoned.*

1143. G. Bower and A. Dick. *Improvements in the purification of gas ordinarily used in illuminating, and in the reduction of ores and smelting of metals by means of such gas so purified.* Dated May 7, 1863.

This invention consists in the employment of heated iron sponge for the purpose of decomposing and removing sulphurous compounds which may be contained in coal gas. The commonly purified coal gas retains small quantities of sulphurous compounds, particularly of sulphuret of carbon, which render it unfit to be employed for metallurgical purposes. By this invention, all sulphur compounds and impurities are decomposed and removed by the action of heated metallic iron in a porous state. *Patent completed.*

1144. T. Small. *Improvements in motive power machinery.* Dated May 7, 1863.

The object of this invention is to gain power by combining together and with certain other mechanism a system of levers. The following is an example of the said combination:—In a suitable framing the inventor adjusts by pivot or fulcrum a lever of the first order; the longer arm of this lever is fitted into an eye or socket formed in a double toothed rack, which has vertical reciprocating motion imparted thereto by two sector wheels having teeth thereon which take or gear respectively into the teeth of the aforesaid double rack; the said sector wheels are mounted on an axis or shaft, and one of said sectors is fast on the shaft, the other sector being loose thereon. These sectors have rotary motion imparted thereto in opposite directions by a bevelled pinion taking into the teeth of bevelled wheels fixed to or formed upon the aforesaid sector wheels, or otherwise connected therewith. The aforesaid sector wheels are so placed with respect to each other, that, when one sector is in action, the other is out of action; the rotation of one sector raises the double rack before mentioned, and actuates the lever connected thereto, and the other sector depresses the rack, and moves the lever in an opposite direction, thus imparting continuous vibrating motion to such lever. The short arm of the lever is connected by a rod to a crank fixed on a shaft, on which is arranged another set of wheels and sectors, similar in all respects to those above described, and gearing into another double rack similar to that above mentioned, and in this manner any number of levers may be connected together. Motion is imparted to the above mechanism by a handle or pulley fixed on the axle of the first set of wheels, and worked either by hand or by a steam engine. The inventor also proposes to adapt a fly-wheel to each of the separate sets of wheels aforesaid to carry the cranks past their null points. *Patent abandoned.*

1145. J. Bettridge. *Improvements in the ornamentation of papier mache and other japanned wares, wood, ivory, and other similar materials.* Dated May 7, 1863.

This invention consists in inlaying articles of papier maché, or other japanned wares, wood, ivory, or other similar materials, with aluminium or its alloys, by which the patentee obtains ornaments in imitation of the more precious metals, such as gold or silver, without their liability to tarnish, with less weight, and at much lower cost. *Patent completed.*

1146. C. A. Day, A. Lamb, and T. Summers. *Improvements in marine engines.* Dated May 7, 1863.

This invention consists in the employment of the ordinary suction air-pumps of steam engines, either for screw or paddle steam vessels, for the purposes of surface condensation, in manner hereafter stated. The patentees apply the two ordinary suction air-pumps of steam engines to surface condensers in such manner that one pump draws from them the condensed or fresh water for the supply of the boilers, and that the other pump draws from them the sea water or condensing water, which it discharges overboard. *Patent completed.*

1147. J. B. P. A. Thierry. *Improvements in the arrangement or construction of furnaces to render the combustion of the fuel more complete, and to prevent the emission of smoke therefrom.* Dated May 7, 1863.

The object of this invention is to procure a more complete combustion of the fuel in the furnaces, and to prevent thereby the emission of smoke. This the patentee effects by blowing in against the bridge of the furnace, by preference, from the front of the fireplace, through one or several jets, superheated dried steam, which, being by intense heat freed from its water, offers to the fire a gaseous combination of carbonic acid gas, oxygen, and azote, and so intensifies the combustion as to prevent the emission of smoke. The steam so used should be at a temperature of about 300 to 600 degrees Fahrenheit. *Patent completed.*

1148. T. Holliday. *An improved blue colouring matter.* Dated May 7, 1863.

This invention consists in obtaining a blue colouring matter by the combination of rosaniline with the benzoate of aniline, or combination of benzoic acid with aniline or its homologues, or mixtures of them. *Patent abandoned.*

1149. P. J. Livsey. *Improvements in compound steam engines.* (A communication.) Dated May 8, 1863.

This invention consists in connecting the piston of the high-pressure cylinder with the beam, so that it will have a larger stroke than the piston of the low-pressure cylinder. Or the invention consists in combining the high and low pressure cylinders with the beam of the engine, so that the low-pressure cylinder will be at one end, and the high-pressure cylinder at the other end of the beam, the connecting rod for the crank pin being placed between the high-pressure cylinder and the fulcrum of the beam. *Patent completed.*

1150. A. Skwarcow. *Improvements in the construction of turn-tables.* (A communication.) Dated May 7, 1863.

This invention consists—1, in bolting or rivetting lengths of railway bars on the under side of the H-iron beaters at the point where the short pieces of the bearers butt against, or are connected to, the long pieces, by which means the strength of the cross bearers is carried through from one side to the other, and the bearers made continuous. 2, In forming the centre spindle on which the table revolves of wrought iron, and of such a form as to allow the horizontal plane of the table to be out of the square with the vertical axis of the spindle without bringing any bending strain on the spindle. 3, In forming the oil cup or box in the same piece of metal as the spindle, and in fixing in the centre of the oil cup a steel stud, upon which rests another steel stud which is fixed to the wrought-iron cap of the table. By this arrangement the surfaces of contact of these two steel studs are always working in oil. And, lastly, in connecting the circular rail with the casting of the central spindle by means of round wrought-iron rods. *Patent abandoned.*

1151. H. Schooling. *Moulding or shaping lozenge paste or other plastic materials.* Dated May 8, 1863.

This invention consists in the adaptation of various well-known machines, now in use for other purposes, to cut, mould, or shape various pastes or plastic materials, but more particularly the article known to confectioners as lozenge paste, into a variety of new forms, notably the adaptation of pill-making machines for making lozenge pills, rolls, oblongs, sticks, pipes, and other shapes, and the adaptation of machines for drawing lead and metal tubes to the drawing of lozenge tubes or hollow pipes. *Patent completed.*

1152. J. S. Grimshaw. *Improvements in looms for weaving.* Dated May 7, 1863.

This invention consists in measuring or registering the measurement of cloth as it is woven in the loom. This the inventor accomplishes by fixing on the emery beam a wheel or wheels with a marker or indicator, so that as the said wheel turns with the emery beam a certain number of revolutions, the marker or indicator will mark the cloth every yard or other length required as it is woven. Or it may be measured by a marker or indicator on the temple, or various other parts of the loom, but it is preferred to measure by the emery beam. *Patent abandoned.*

1153. C. L. Braithwaite and J. Hirst. *Improvements in machinery for feeding slivers of wool and other material to carding engines.* Dated May 8, 1863.

This invention consists in the employment of a V-shaped frame in the feeding apparatus used in carding engines for feeding the slivers to the machine, and in driving the shuttle by toothed gearing and chain bands, all as described. *Patent completed.*

1154. J. H. Bailey. *An improved mechanical movement for producing an impelled current of air for lamps, and which may be used for other purposes.* (A communication.) Dated May 8, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1155. J. C. Droop. *An instrument or holder for holding nails, screws, and other fastenings.* Dated May 8, 1863.

This invention consists in magnetizing or applying magnetism in connection with a tool called a "tack or nail holder," by which means tacks, nails, or other similar fastenings may be picked up and held by magnetic attraction in the right position for driving with a common hammer or screw driver. The picking-up part of this "tack or nail holder" the inventor prefers to construct with a claw, and having a collar of india rubber, gutta percha, or other suitable non-conducting material, to prevent the tacks, nails, screws, or other fastenings adhering thereto, otherwise than to the exposed magnetized part of the "nail holder" which is presented to the tack, nail, or screw to be picked up. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated September 17, 1863.

2288. C. H. Chadburn, 71, Lord-street, and W. J. Tristram, 34, Adlington-street, Liverpool. Improvements in the construction of ships and other vessels, and in the machinery for propelling them.

Dated September 28, 1863.

2383. J. Bailey, turret clock manufacturer, Salford, G. W. Blake, agent, Manchester, and W. H. Bailey, turret clock manufacturer, Salford. Improvements in barometers, gas regulators, and other apparatus for regulating and indicating the flow and pressure of liquids and fluids.

Dated October 13, 1863.

2514. A. Crellin, Dorset-place, Dorset-square. Improvements in apparatus applicable to omnibuses in order to indicate the number of persons entering such vehicles, and the distances travelled by the passengers.

Dated October 19, 1863.

2557. L. Eynard, 48, Langham-street, Portland-place West. Improvements in brakes for railway trains and other purposes.

Dated October 23, 1863.

2617. J. Ronald, Liverpool, merchant. Improvements applicable to the machinery used for spinning hemp, flax, manilla, wool, and other like long fibrous material from the hand, or when previously formed into a "sliver."

Dated October 24, 1863.

2632. A. and W. P. Potter, Longfleet, Dorsetshire. Improvements in railway waggons for the transfer of minerals and general merchandize.

Dated November 2, 1863.

2709. T. Adams and J. Scott, 14, Little Tower-street, stationers. An improved kind of envelope for the transmission of patterns or samples of merchandize by post.

Dated November 3, 1863.

2716. J. Mackintosh, North Bank, Regent's-park. Improvements in taps or cocks for liquids or gases.

Dated November 6, 1863.

2756. R. Saunders, Croydon, gentleman. Improvements in fastening together the parts of ships and vessels, and in respect to the more efficient caulking of the seams thereof.

Dated November 12, 1863.

2810. B. A. Murray, Manchester, machinist. Improvements in machinery for doubling, twisting, and winding silk and other fibrous substances.

2812. A. Craig, Rock Ferry, Birkenhead, engineer. Improvements in distilling hydro-carbons from coal, shale, and other bituminous substances, and in apparatus employed for that purpose.

2816. H. Holden, Preston. Improvements in shuttles for weaving.

2819. W. E. Gedge, 11, Wellington-street, Strand. An improved process and apparatus for amalgamating the precious metals. (A communication.)

2822. L. E. C. Martin, 32, Albion-street, Hyde-park. Improvements in apparatus for generating steam.

Dated November 13, 1863.

2826. C. W. Siemens, Great George-street, Westminster. Improvements in apparatus for submerging submarine telegraph cables. (Partly a communication.)

2828. W. Robertson, Manchester, engineer. Certain improvements in machinery for spinning and doubling.

2830. G. Remington, Haverstock-hill, member of the Institution of Civil Engineers. Improvements in atmospheric or pneumatic railways, and locomotive engines to be used in connection therewith.

2832. W. F. Dearlove, 263, Goswell-road. Improvements in means or apparatus for effecting the chopping or separation of animal and vegetable substances.

2834. J. W. Drummond, New York, United States. Improvements in looms for weaving.

2835. G. K. Geyelin, civil engineer, 17, King-street, Cheapside. Improvements in the construction of water-closets.

2836. G. T. Bousfield, Loughborough-park, Brixton. Improvements in apparatus used when rolling blinds, maps, and other articles on rollers. (A communication.)

Dated November 14, 1863.

2838. M. A. Muir and J. McIlwham, Glasgow, machinists. Improvements in looms for weaving.

2839. J. Medway and S. Joyce, 15, Owen's-row, manufacturing chemists. Improvements in the manufacture of starches by the introduction of colouring matters.

2842. J. P. Binns, Guildford-place, Farringdon-road. Improvements in sewing machines.

2844. J. C. Wilson, 14A, Cannon-street, civil and mechanical engineer. Improvements in cotton gins on the roller principle.

2848. T. S. Prideaux, 209, Piccadilly. Improvements in the construction of armour for ships of war and land batteries.

2850. W. A. Lyttle, 5, Priam-place, Albion-road, Hammersmith, gentleman. Improved covers for umbrellas, parasols, or sunshades.

2852. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the treatment or manufacture of wrought and cast iron and steel. (A communication.)

2854. J. Lewis, Elizabeth, United States. Improvements in rudders.

2856. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in presses for lithographic and other printing. (A communication.)

2858. R. A. Brooman, 163, Fleet-street, patent agent. Improvements in engines and boilers specially applicable for agricultural purposes. (A communication.)

2860. T. Williams, 232, Bolling-street, Bowling, York, and I. Naylor, 13, St. James's-square, Horton, Bradford, worsted spinners. Improvements in paper spools or tubes used in spinning and doubling machines.

Dated November 16, 1863.

2864. C. Pengelly, Bodmin, mining engineer. Improvements in mechanism or apparatus for reducing or pulverizing ores and other substances required to be reduced or pulverized.

2866. G. Thonger, Birmingham, chemist. Improved modes of preventing accidents arising from the sale or use of poisons.

2868. R. Griffiths, Mornington-road, Regent's-park, engineer. Improvements in propelling ships or other vessels.

2869. A. Pollock, H. and R. T. Power, Liverpool, merchants. An improved method or apparatus for affixing labels on bottles, canisters, and other like articles.

2870. G. T. Bousfield, Loughborough-park, Brixton, Surrey. Improvements in the manufacture of cartridges. (A communication.)

2872. J. J. Maurer, Paris, France, gentleman. Improvements in towing boats and other vessels.

2874. C. W. Harrison, Battersea, civil engineer. Improvements in filters.

Dated November 17, 1863.

2876. P. M. Parsons, Blackheath, civil engineer. Improvements in the construction and manufacture of ordnance, parts of which are applicable to small arms.

2878. W. Cowan, Edinburgh, Mid Lothian, gas meter manufacturer. Improvements in gas meters.

2880. J. Betteley, Liverpool, iron merchant. Improvements in sheathing ships and other vessels.

Dated November 18, 1863.

2883. R. Mayer, Birkby, near Huddersfield, gentleman. Improvements in breech-loading firearms, and in bayonets and cartridges connected with the same.

2886. W. M. Williams, Oak Alyn, near Wrexham, manufacturer. Improvements in apparatus for the distillation of coal and peat, and such other substances as are or may be used for the manufacture of solid and liquid volatile hydro-carbons, or for the manufacture of the said hydro-carbons and coke.

2888. W. Wigfall, Sheffield, brush manufacturer, and G. Jolly, brush maker. An improved explosive compound to be used in the manufacture of cartridges, and an improved mode of manufacturing cartridges therewith.

2890. J. Stewart, Leigh, boiler maker. Certain improvements in steam boilers or generators.

2894. H. Hirzel, doctor of philosophy, Terminus Hotel, London-bridge. Improvements in the manufacture of colouring matters suitable for dyeing and printing.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated November 30, 1863.

2998. M. R. Pilon, United States. Improvements in firearms.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, December 8, 1863.

1861. J. W. Welch. Sizing and finishing fabrics.
1874. J. Jewell. Setting boilers.
1857. P. H. Girardin. Lamps.
1882. E. Sturge. Coating metallic surfaces.
1883. G. Inskeep. Mill for grinding bones.
1887. J. B. Howell. Ordnance firearms and projectiles.
1889. G. Smith. Buffing and traction apparatus of railway carriages.
1891. T. Apps. Four-wheeled vehicles.
1893. G. Sigl. Force pumps.
1902. R. A. Brooman. Dyeing mixed animal and vegetable fibres. (A communication.)
1904. G. Taylor. Shaping boiler and other plates.
1909. E. Sutton. Fastenings for cigar cases, &c.
1913. J. W. P. Field. Sheaths or cases for staves.
1919. J. Abrahams. Brakes.
1921. G. Stevens. Apparatus for effecting a regular supply of air.
1125. W. E. Newton. Moulding and casting hollow projectiles. (A communication.)
1953. J. H. Johnson. Preventing sea sickness. (A communication.)
1958. E. Morewood. Coating metal.
1984. W. Gray. Certain parts of reaping machines.
1996. W. Clark. Lamp for burning coal oil. (A communication.)
2006. H. Brown. Burners for lamps.
2023. E. Scott. Regulating the speed of engines. (A communication.)
2026. E. Lord. Preparing, spinning, and doubling cotton.
2036. J. Smith. Finishing woven fabrics.
2091. H. Batt. Roughing horseshoes.
2151. A. V. Newton. Sewing by machinery. (A communication.)
2300. H. C. Huskinson. Buttons.
2561. W. Ingham and I. Wood. Copper rollers.
2676. O. C. Evans. Digging machinery.
2731. J. A. Barral and L. A. Coohery. Manure.
2752. R. Sellar. Harrows.
2784. N. Thompson. Stopping bottles.
2809. G. Haseltine. Endless chain horse-powers. (A communication.)
2834. J. W. Drummond. Looms.
2836. G. T. Bousfield. Apparatus used when rolling blinds, maps, &c. (A communication.)
2837. T. Harrison. Machinery for cutting and excavating coal.
2838. M. A. Muir and J. McIlwham. Booms.
2839. G. T. Bousfield. Cartridges.
[illegible] W. Wigfall and G. Jolly. Cartridges.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed December 4, 1863.

1407. W. A. Brown.
1410. C. E. Newcomen.
1412. N. Walton.
1415. W. Clark.
1419. W. E. Gedge.
1423. H. Reynell.
1426. J. Petrie.
1442. W. Roberts.
1450. T. M. Harrison.
1451. M. Henry.
1455. C. L. V. Tenac.
1465. F. A. and F. Calvert.
1466. G. Davies.
1477. J. Jones.
1479. T. Wrigley.
1489. S. S. Robson.
1492. J. Forrester.
1530. R. Jobson.
1531. E. Gossiaux.
1551. J. L. Clarke.
1555. W. L. and T. Winans
1556. W. L. and T. Winans
1557. W. L. and T. Winans
1558. W. L. and T. Winans
1565. W. Snell.
1573. W. E. Newton.
1773. M. Henry.
1776. D. C. G. Clemm.
2041. R. Baillie.
2129. C. Harratt.
2228. E. Oliver and G. Myers.

Sealed December 8, 1863.

1443. T. Adams.
1446. T. Evans and E. Hughes.
1470. G. Bedson.
1471. T. C. March.
1473. R. Hughes.
1480. J. Hopkinson.
1483. T. A. Elliott.
1486. M. B. Westhead.
1488. H. G. W. Wagstaff.
1490. J. Shand.
1501. J. J. Shedlock.
1502. F. S. Williams.
1509. A. J. Fraser.
1570. W. L. and T. Winans
1571. W. L. and T. Winans
1572. W. L. and T. Winans
1589. S. Knowles and R. Hayward.
1593. S. Smith.
1651. J. King.
1666. H. A. Bonneville.
2245. M. Gerstenhöfer.
2546. J. H. Johnson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

143. J. Jobson.
2947. A. Jackson.
2959. W. Pilkington.
2960. W. and J. Galloway
2963. E. T. Hughes.
2980. C. S. Duncan.
2982. C. W. Siemens.
2985. E. Morewood.
3009. J. Robson.
3010. R. Mushet.
3017. D. Annan.
3030. R. Mushet.
3045. R. Mushet.
3070. R. Mushet.
3138. J. Chatterton and W. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2861. F. Siemens.
2867. A. and W. Bullough.
2874. J. Apperly and W. Clissold.
2884. D. Crawford.
2894. W. H. Bowers.
2915. T. Vicars, sen., T. Vicars, jun., T. Ashmore and J. Smith.
2916. T. Peake.
2935. T. and W. Wheatley

LIST OF SPECIFICATIONS PUBLISHED.

For the Week ending December 5, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
2909*	0 4	799	0 4	809	0 4	817	0 4	832	0 4	847	0 8
761	0 6	800	0 4	810	0 4	818	0 4	833	1 2	849	0 10
781	1 4	801	0 10	811	0 8	819	0 10	834	0 4	850	0 10
785	0 10	802	0 6	812	0 4	820	0 6	839	0 8	851	0 4
790	0 8	803	0 8	813	0 8	821	0 4	842	0 10	853	0 6
795	0 4	804	0 10	814	0 8	822	0 4	843	0 4	854	0 4
796	0 4	805	1 0	815	0 8	824	0 4	844	0 4	855	0 4
797	0 8	806	0 6	816	0 10	826	0 10	845	0 10	856	0 4
798	0 4	807	1 0								

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	p ct
IRON:—					
Welsh Bars, in London	per ton	7 10 0	to	0 0 0	
Nail Rods	do	8 0 0		8 10 0	
Hoops	do	10 10 0		0 0 0	
Sheets, single	do	£11 10 0		0 0 0	
Staffordshire Bars	do	9 10 0		0 0 0	
Bars, in Wales	do	6 10 0		6 15 0	
Rails	do	7 0 0		0 0 0	
Foundry Pigs, at Glasg, No 1	do	3 0 0		3 6 0	
Swedish Bars	do	11 10 0		12 10 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		16 10 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	105 0 0		0 0 0	
Hammered Bottoms	do	115 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	110 0 0		0 0 0	
Tough Cake and Ingot	do	98 0 0		0 0 0	
Tile Copper	do	98 0 0		0 0 0	
Best Selected	do	101 0 0		0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8½		0 0 9	
Fine Foreign	per ton	100 0 0		102 0 0	
TIN:—					
English Block	per cwt.	5 15 0		0 0 0	2½
do Bar	do	5 16 0		0 0 0	
do Refined	do	6 0 0		0 0 0	
Banca	do	6 2 0		6 3 0	nett
Straits	do	5 17 0		0 0 0	
SPELTER:—					
On the spot	do	18 7 6		0 0	nett
ZINC:—					
English Sheet	do	21 0 0		0 0 0	2½
QUICKSILVER	per btl.	7 0 0		0 0 0	3
REGULUS OF ANTIMONY:—					
French star	per ton	3[illegible] 0 0		0 0 0	2½

TIMBER, duty 1s. per load, drawback 1s.

Teak	load £12	0	£13	0
Quebec, red pine	3	10	4	10
" yellow pine	3	10	4	10
St. John, N.B., yellow	0	0	0	0
Quebec oak, white	5	10	6	10
" birch	3	10	4	10
" elm	3	10	5	0
Dantzic oak	3	10	6	10
" fir	2	10	3	10
Memel fir	3	5	3	10
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
" yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
" St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	18	10
St. John, white spruce	14	0	15	10
Yellow pine, per reduced C.				
Canada, 1st qual.	17	0	18	0
" 2nd do.	11	0	12	0

Archangel, yellow	£13	0	13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
" white.	9	0	9	10
Gefle, yellow	10	10	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.				
Christiania, yellow	21	0	23	0
Deck Plank Dantzic, per 40 ft. 3 in.	0	14	1	[illegible]
PUMICE STONE pr ton	5	10	9	0
OILS, &c				
Seal, pale ... per tun	47	10	0	0
Sperm body	73	0	75	0
Cod	54	0	0	0
Whale, Sth Sea, pale	45	0	46	[illegible]
Olive, Gallipoli	58	0	58	10
Cocoanut, Cochin	46	10	0	0
Palm, fine	36	10	0	0
Linseed	35	15	36	0
Rapeseed Eng. pale	41	0	0	0
Cottonseed	30	10	37	0

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THE MECHANICS' MAGAZINE.

Contents of the Last Number.— Page

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 18, 1863.

THE PRIZE SYSTEM.

Certain institutions may be found in every nation, which, having outlived the necessities which called them into existence, have ceased to retain their original value, and remain in being only by the prescriptive right of antiquity and the prejudices or likings of a class. The system of giving prizes to men, or things produced and invented by men, on particular occasions, is one among many such institutions. It takes its rise far back in the mists of the past—so far back that the history of its origin is lost in doubt—the wreath of laurel given to the victor in the Olympic games, presenting us with one of the first instances of its periodical application to the attainment of a particular end. From the ancient to the modern world is but a step after all; and we find the customs of the past, existing with us in the present, under a modified form, suited to our tastes and our wishes.

The main lever employed by the Royal Agricultural Society to move the engineering world has been the prize system—medals and money for the "most excellent," and money without the medals for the next in rank, and so on down the scale to the zero of "honourable mention." Nor has the lever been wanting in power. There is little room for a doubt that the system has been effective in improving implements, engines, and agricultural mechanism generally, up to a certain point. But there is room for grave doubt as to whether it will continue to be effective, while the laws governing the administration of the Society's justice remain in their present form. Fifty years ago the operations of the farmer derived, literally speaking, no assistance from the labours of the engineer. The ploughwright enjoyed his local reputation for the excellence of particular instruments, and the carpenter and his mates, turned out waggons and carts which answered the purpose for which they were intended passably well. There was no opening for the engineer. Thrashing or ploughing machinery was useless in the absence of the motive power which could alone enable it to fulfil its mission. There was, therefore, no possible motive for designing or constructing it. We doubt, too, if high rents and keen competition held out a stimulus sufficient to make the farmer regard innovation with favour. Times change, however, and just when our Continental neighbours began to find it worth while to supply Manchester and Leeds with breadstuffs, the advent of the portable steam engine brought new men on the scene, and the mechanician taught the agriculturist, how to win more bread and more gold from his land than he had dreamt of; and since then the engineer has been the British farmer's best friend.

But the British farmer does not always know what is good for him; and if this is, and has been, true as regards those questions of social ethics with which he should be best acquainted, how much more likely was it that he should form an incorrect estimate of the powers and qualifications of a class of implements and machines in which he was devoid of experience? An engine or a thrashing machine, a corn drill or a chaff cutter, might do its work well, and yet not so well as the implement of a rival maker. But the farmer, who seldom wanders far from home, was not very likely, if left to his own unassisted judgment, to form a substantially-correct opinion on such matters. And here, wisely and thoughtfully, the Agricultural Society determined at once to provide for the consequences of this ignorance or inexperience, and stimulate the engineer to the production of implements and machinery best adapted to the wants of the agriculturist by the donation of prizes, which were tantamount to a diploma of merit to the receiver. The benefit once experienced, the example was quickly followed, and the spread of Agricultural Societies all over the country has been something very remarkable. It is questionable, however, whether their labours in the implement department, have been productive of anything like as much good of late years as they were previously, and the total abandonment of the prize system has been subject for deep consideration with many, during the last year or two.

Mr. Chalmers Morton has recently given his opinion on this subject to the world, in a Paper read before the Society of Arts; and, if long experience and careful thinking can impart value to sentiments, those expressed by Mr. Morton are well worthy of attention. In the course of his Paper he places the evils attending the prize system as conducted by the English Agricultural Society, prominently before his readers. On the one hand, he shows that the decision of the judges is but too often pronounced after a trial under conditions which preclude the possibility of forming a correct estimate of the powers of the machine under probation, and that on the other, the work performed by various implements—ploughs especially—is often so nearly identical, both in quality and quantity, that a decision in favour of any one is unjust to the remainder. As a natural result, medals and money prizes have lost much of their value as exponents of merit, and the public attach little importance to their possession by individual firms to the exclusion of others. This does not prove that the system is wrong in the abstract; it is only wrong in its mode of application. In the infancy of agricultural engineering, very simple and crude tests were quite sufficient to determine the qualities, good or bad, of the implements exhibited. This state of things did not last very long however. The standard of excellence was rapidly arrived at by one great firm after another, until the difficulty became, not to decide which was most meritorious, but if a really appreciable difference had any existence at all. The tests which were employed ten or a dozen years ago, are useless now; and as a result, either the entire arrangements for the giving of prizes must be altered and extended, or the practice done away with altogether, unless, indeed, the Society prefer to present a portion of their funds yearly to the engineers who graciously send implements to their shows. In such a case, perhaps, the names of the recipients might as well be decided by lot as in any other way. The fact is, that the time for agricultural prizes has passed away. The English farmer can now bring past experience of his own and his fellows to bear; and we question if the decision of judges or committees influence his purchases to any considerable extent.

The bearing of the system on the proceedings of the engineer, seldom comes before the public; yet the question assumes a very peculiar aspect when considered in this light. Morally it has done harm. Had such a thing as a portable engine no existence, this might not have been the case, at least to the same extent; for most other machines must be really good in themselves in order that they may do good work, and little or nothing would be gained by bad workmanship or materials. But, unfortunately, it is not so with the steam engine, on which the vitality of the homestead, to a great extent, depends. The portable, which best performs its work during the few short hours of trial to which it is exposed in the show-yard, may be, of all others, the worst suited to meet the requirements of the farmer over a series of years. The world at large knows little or nothing of the anatomical peculiarities of many an engine which has borne away the prize from a host of competitors. The careful dissection of a "racer," would reveal many a little circumstance, sufficiently startling; while the investigation of its history for the few months before the season of its display would reveal the expenditure of an amount of ingenuity highly creditable to all concerned. The young hands usually have a fair chance at this kind of work. We know of instances where a prize is given in the drawing office, now and then, for the best design for a "racer." and happy is the individual whose engine takes a medal. The practice is not universal, neither is that of building this class of engine; and we are thankful that such is the case, as the custom can hardly be considered conducive to the honesty of the rising generation of agricultural engineers. In addition to this, the expense of attending shows regularly is something enormous. Mr. Morton states that the expenditure of one firm in the this way has amounted to £30,000, and that of another to £20,000; while the spoiling of the best men, and the disorganization of the work, are past estimate. We know who pays such bills as these—not the firms, but their customers.

Shows would not be deserted, even in the absence of prizes. In the first place, it is well worth the maker's while to bring his wares before the public. Some firms have a character to make; others that already made, to maintain against all comers; and good names and high reputations may be won and lost at a show, without the interference of an authorized judge, or the giving or withholding of a gold medal. Novelties are of little value unless they are brought before the public, who can now pretty well discriminate for themselves. The Smithfield Club Show, held last week, affords an example. The display of implements and machinery was one of the best we ever witnessed; yet the inducement held out by the prospect of taking a prize, had nothing to say to the presence there of engine or thrashing machine, cultivator or plough, nor is it necessary that it should. It requires no committee to point out the merit of such an invention as that involved in Barnard and Bishop's lawn-mower, wherein a single ring, covered with vulcanized rubber, performs the work of a train of complicated gearing; the good qualities of Burgess and Key's McCormick's sheaf-reaper, or the "Jack-in-the-box" driving gear of Clayton and Shuttleworth's colossal traction engine. Such things must, after all, stand or fall by the decision of the great mass of purchasers, and not by that of a limited number of judges, however able, talented, or industrious they may be. The working of any machine under show-yard conditions is a very different affair from working it on an extended scale in the open country; and if prizes are really to retain their value as guides to the intending purchaser, it can only be by extending the system of examination by committee, to the homestead and the cornfield, to the rick side and the fallow—a system far too costly, we fear, to pay, although the results obtained would be all but invaluable to the agricultural world.

ROLLING STOCK, AND ITS MAINTENANCE.

MEN seldom spend money in vast sums with a strict regard to principles of economy. This is true, even when the spender enjoys the rights of proprietorship in the fullest sense. It is yet more true of public bodies who have the disposal of funds really belonging to others; and the larger the sums, the greater the disregard for economy. The fact is, that the mind is prone to forget small things in the presence of those which are great; and the interests involved in the expenditure of a million may be so vast, that the waste of a few hundreds is easily passed over almost without comment. Yet a million is but an aggregate of units, and the absolute waste of a single sovereign is as much to be deprecated as though it formed an important instead of a very trifling part of the sum. It is an infringment of those laws which give vitality to mercantile transactions, and though not traceable to fraud, it is direct evidence of negligence, ignorance, or prejudice. No limited number of men not forming a Government, ever represented such a vast capital as the gentlemen who make up our Railway Boards; and it is, therefore, natural to expect that all their procedings should afford evidence of a certain absence of strict prudence in the management of monetary concerns. But it is to be recollected that Railway Boards and Railway Management are not things of yesterday; that all the aids of science may be invoked at the nod of a director who wishes to improve on existing arrangements; and that the experience had already in railway matters is of the amplest—therefore, it is not unreasonable to expect, that waste may be reduced in every department to the lowest point, to the great benefit of expectant shareholders, and to the great glorification of those who hold the reins of government, in the eyes of the whole world. But it is not so. The rolling stock of the United Kingdom consists of 219,500 vehicles, or thereabouts; and it is not too much to say that these afford just so many examples of uneconomical expenditure—uneconomical in that they are not thoroughly well adapted to the end in view, that they do not answer their purpose as well as other vehicles of a different construction might be made to answer it; and that they cost really more money than they ought, for maintainance, repair, and working. This is a direct defect. An indirect, but not less serious one, is to be found in injury done to that which should be, but is not, permanent way. The system which permits the employment of the heavy carriages, trucks, waggons, and engines now in general use, is merely another instance of that want of economy which, we have said, usually attends on the disbursement of large sums of money; and the amelioration of its defects cannot be hoped for from the aid of science alone, unless some science exists which will uproot prejudice and banish the red tapeism of those who have the power, if they had but the will, to amend matters, reduce wear and tear to a minimum, and thereby ultimately increase dividends by a handsome amount.

The cost of repairing and renewing the rolling stock of our railways amounts to £1,242,714 per annum, or about 8¾ per cent. on the total expenditure of the companies. This is a very considerable sum; but it by no means represents the whole loss incurred. It is probable that all our trucks and carriages are one-fourth heavier at least than they need to be. As a consequence, an equal excess of weight is to be found in our locomotives; and the amount of injury to rails, sleepers, and road, which results from this fact alone, is something which has never yet been estimated. Most of this weight is, of course, the effect of the heavy scantling of every portion of the trucks or waggons, rendered necessary far more by the fearful knocking about to which they are exposed in the process of shunting and making up trains, than to anything else. High speeds, over bad roads, have of course something to say to it; but, after all, not so much as might be thought probable at first sight. Of all the unscientific and irrational ideas which have ever taken possession of the mind of man, that of resisting the mechanical forces called into play by a railway train travelling at speed, by brute force alone, is the most absurd. Imperfections in the road should be humoured by elastic springs, not contended with by heavier wheels and axles, and more massive truck and carriage frames. Wise men in the Potteries will not send their goods by rail, because, although not over fragile, and carefully packed, they get broken by the semi-collisions which go on from one end of a string of unbuffered waggons to the other, every time the train starts or stops. Dead weight, and want of elasticity (or perhaps suppleness is a better word), in carriages, engines, and road, is the curse of our railway system; and until the former is reduced, and the latter provided, transit by steam power will never be all that it should be.

In the absence of anything like direct experiment, it is impossible to say what is the minimum proportion which the weight of a vehicle should bear to the load which it supports. But it is certain that it is not nearly approached on our railways. Perhaps we may except first-class carriages, which can scarcely be made much lighter, and yet retain all the peculiar arrangements in which the modern traveller luxuriates. Those who use first-class carriages are able to pay for the accommodation, and they have a right to enjoy it. Second and third-class carriages could be lightened with advantage. It really is not in the superstructure which contains the paying load that the excess of weight is to be found; but in the under framing, which is thus heavy because the road is bad; and the road is bad because the engines are too heavy for its powers of endurance. Thus each effect becomes, in turn, a cause tending to waste money. The loss on passenger stock is, however, as nothing when compared with that on goods stock. Over 180,000 mineral and cattle trucks may be found on our railways, and scarcely 20,000 passenger carriages and brake vans. These trucks are never fitted up as they should be, were proper regard had to the well-being of the track on which they run. The wheels do not receive sufficient attention, seldom paying a visit to the lathe until the last moment. The springs are flexible, it is true—that is to say, they will bend if loaded sufficiently; but the benefits which they confer have far more existence in the ideal, than in the actual. We should be afraid to say how many are without buffers, and are thereby exposed to shocks continually, which literally pound them to pieces day by day; and as to that care which provides for small defects before they have time to grow into larger ones, goods stock meets with nothing of the kind.

In the complete remodelling of their present goods stock, railway companies would assuredly open up a source of economy not thought much of at present. Trucks are made heavier year by year; and that which once represented 30 cwts., or 2 tons of unpaying load, has now swelled to three times as much. Their numbers increase daily; yet there is no improvement in their construction, or in the mode of working them. As a consequence, they destroy the permanent way; they knock each other to pieces; and are so heavy and unwieldy, that their shunting has become a serious evil at most goods stations. It is difficult to say how many a catastrophe has taken its rise from the utter inability of the officials to get some ponderous vehicle out of the way of a coming train in time. That they have not been few, we feel certain. By the employment of easy springs, good buffers, and tight couplings, the road, as well as the engine, would be spared, and the durability of waggons and trucks materially promoted.

THE ORDNANCE REPORT, 1863, CONDENSED; AND CONCLUSIONS FROM IT.

No. VI.

THE ARMSTRONG SYSTEM.

OUR last number concluded with an exposition, from his own lips, of Sir William Armstrong's arduous labours, as he regards them, in overcoming the difficulty of making hoops of coiled iron. He no doubt was solaced by the reflection that the cost came, not out of his, but out of the public purse. According to competent witnesses, including Mr. Whitworth, Mr. Hulse, Captain Blakely, and the Manager of the Butterley Company, there not only was no difficulty in the processes of manufacturing coils of iron, but they were well known and practised before Sir William Armstrong turned his attention to the subject. The only thing wanted was a plant, on a sufficiently large scale, to manufacture coils for heavy guns. "At Woolwich" (says Mr. Hulse, and he might have added at Elswick), "they had a furnace 90 ft. long; they had coiling apparatus and steam hammers purposely adapted to the work." By these appliances, and not by the inventive genius of Sir William Armstrong, the difficulty he referred to was overcome. At Woolwich and at Elswick, there was no limit to the outlay of capital requisite to enable Sir William Armstrong to carry out his projects, however crude or ill-considered they might be. If he failed in one plan he tried another, till he succeeded; but not at his own expense. He was in the happy position of an inventor supported by a capitalist, who supplies him with any amount of money without grumbling. It is difficult to understand how Sir William Armstrong can conceive himself entitled to any credit for results due entirely to the favour shown to him by the public authorities. It is, on the contrary, a grave reproach to him and to them, that whilst the resources of the State were placed at his disposal without limit, other projectors met with no encouragement, and were even refused a trial of their systems at their own expense.

Sir William Armstrong concludes his own eulogy of his own ideas, and his own merit and success, in producing tubes of coiled iron, with the following peroration:—"This principle of constructing the gun of coiled-iron tubes is that on which I started, and to which I have always adhered. I began with 3-pounders of 5 cwt., and I have ascended step by step to 600-pounders of 22 tons. Now, whatever question there may be with respect to the originality of the idea, I think it must be conceded that the country has, at all events, obtained, through the expenditure that has been made, the development of that principle of construction, which is not only very valuable and important, but which has been carried to a much greater extent than there was any reason originally to anticipate. That this system remains the best that is available, is

recognized by the fact that every inventor in rifling, who wishes to get a gun capable of resisting the highest possible charge, avails himself of it. The safety of the principle, I consider, has been established by the fact that, out of nearly 3,000 guns made on this principle, no one gun has burst explosively; and, in fact, no one gun has failed under the most trying tests, excepting by a gradual process, which has given timely notice of the approaching destruction of the gun, and has prevented any possibility of a dangerous accident."

In this statement there is a series of *non sequiturs*. Firstly, it does not follow, because the War-office, led or misled by Sir W. Armstrong's one idea, would listen to no other, that other ordnance constructors, if that Department had allowed them to compete on equal terms, would not, in nine years (from 1854 to 1863) have introduced a better and more economical plan of making coils of iron, or a better plan of strengthening guns, into the service. Secondly, if the coil system should not prove to be the best—a point on which great doubt exists—"the development of that principle of construction" might have been accomplished simultaneously with the development of other systems with an expenditure infinitely less than three millions, which literally is the price of a *single* experiment. Thirdly, if a better system than the "Armstrong" be introduced, and the mode of construction which "came to be viewed" as the Armstrong is abandoned, which seems to be possible, the development of the principle will be neither "valuable or important," but a positive loss to the country, and highly detrimental to the land and sea service.

In Sir William Armstrong's elaborate defence before the Committee, there is not a word in answer to the serious charge against him and the War Department, that he has received the support of the Government to develope his ideas to the exclusion of all competitors.

Plausible as his statements to the Committee are, they afford abundant proof that, from 1854 to 1863, Sir William Armstrong has had no fixed ideas. During that long period, he has been experimenting with the public money, making frequent changes in his principles and modes of construction. He began with a wrought-iron tube, made from a solid forging, for the inner barrel, which he covered with hoops of coiled wrought iron. This experiment was a failure. He tried steel inner tubes without success; other manufacturers have used them successfully. Finally, he committed himself to the coil system for the *inner*, as well as the outer tubes. "This principle of constructing the gun," he says, "is that on which I started, and to which I have always adhered." And yet he is constrained to admit "that the only alternative lies between steel and coiled barrels of wrought iron." Does not this avowal betray Sir William Armstrong's misgivings lest steel should supersede coiled iron and entirely displace it? Such, in fact, is the opinion of eminent and experienced manufacturers of ordnance. Krupp, of Berlin, makes heavy guns entirely of steel. Whitworth makes the inner barrels of his guns of solid bars; he "would not think of making them of welded iron." Blakely uses steel barrels. The Mersey Steel and Iron Company are unshaken in their confidence in solid blocks of their metal.

If these opinions should prove to be correct, the coil system will be condemned, and all the money spent upon it will be lost to the country. Sir William Armstrong admits that "the only question is whether we can obtain the proper metal for a steel barrel with uniformity of quality." In the mean time, he has committed himself and the country to the coil system. But this question was raised by his competitors eight or nine years ago; and the Government, deluded by Sir William Armstrong's determined advocacy of the coil principle, turned a deaf ear to their proposals.

Here is the point which casts deserved blame on the War Department officials. They would listen to nobody but their one favoured projector, who, having secured the patronage of Sir Benjamin Hawes, the Under-Secretary of War, and allied himself with Mr. Rendel, a family connection of Sir Benjamin Hawes, and Captain Noble, the Secretary of two Special Ordnance Committees which recommended the Armstrong system for adoption, obtained so commanding and influential a position at the War-office, that he was enabled to thwart the endeavours of every other artillerist who made proposals to Government to construct guns, either of coiled iron or on other plans, at the public expense. The consequences of this combination, which conferred a virtual monopoly on the Armstrong party, has been most disastrous to the country. It has left all other plans but the Armstrong coil system untried. The manufacturers of solid masses of metal, whether homogeneous iron or mild steel, have received no encouragement from the Government. If to that important object a tithe of the money lavished on the Elswick Works had been devoted, there can be no doubt that before this time, our manufacturers would have produced homogeneous metal of uniform quality, which is stated to be the great desideratum for the construction of ordnance.

We have already shown from the evidence that the Mersey Steel and Iron Company were, in 1860, on the point of obtaining the required degree of perfection in their solid forgings The Ordnance Select Committee reported that the guns made of blocks of metal manufactured by that firm, after undergoing the usual tests, had "shown an endurance ample for the requirements of the service," and that the guns cost 15 to 25 per cent. less than the Armstrong coil guns. The Committee recommended that six blocks of the Mersey steel should be ordered for further trials; but such was the Armstrong influence at the War-office, that no attention was paid by the Secretary of State to that recommendation; and this proposition, which, if acted upon successfully, would have been fatal to the Elswick monopoly, to use an expressive term which the case deserves, was "burked."

We have entered very fully into the coil principle of construction, because Sir William Armstrong relies chiefly on that part of his system, as entitling him to the gratitude of the country, and as justifying the enormous expenditure incurred in carrying out his plans. We have shown how unfounded is the merit he assumes to himself on that ground:—1st. Because he is not the inventor of the coil system. 2nd. Because many others, if the opportunity had been afforded to them (which was not done), would have produced the same, and, probably, better results than he obtained. 3rd. Because it is by no means certain that the coil plan is the best method of strengthening guns.

We might leave the case of the Armstrong system there, and fairly conclude that it is condemned by the evidence bearing upon the feature which its author chiefly claims credit for. But we should fail in doing justice to the Ordnance Report, and we should leave the *exposé* of the real character of the Armstrong gun incomplete, if we did not refer to the evidence on the methods of breech-loading and rifling, which form essential parts of the combination that "came to be viewed as the Armstrong system." Pursuing the same course as before, we will quote evidence from the Report.

Certainly no witness can be more trustworthy than Colonel William Bethel Gardner, R.A. He is "the Chief Instructor in Gunnery at Shoburyness, has held his present position since May, 1859, and during that period has seen very many experiments tried with Armstrong guns of every calibre." The following is an epitome of the evidence of that valuable officer:—"With *considerable care*, the Armstrong breech-loader would be a useful gun; but I have considerable doubts whether it is so formed as to stand the rough usage of service. The weak points of the gun are the vent-piece and the breech screw—the vent-piece is defective in strength, and the breech screw is liable to injury. At the ordinary practice last week two vent-pieces broke very quickly. Since I have been acquainted with the experiments at Shoeburyness, 60 or 70 vent-pieces have been broken." He explains that to ensure accuracy in fitting the moveable parts of the breech, "the allowance between the nose of the vent-piece and powder chamber should be exactly 2-1000ths of an inch, or 4-1000ths difference in diameter,"—"nobody, or at least, not one man in a hundred, when at all excited, would look, or, in fact, have the means of ascertaining, that those dimensions are exactly true; then, if burr occurs, or if these fittings, when you came to thousandth parts of an inch, are not observed, you will probably have the result which we had the week before last." "On service it would not be very easy to remedy those defects, unless the men are very different from what they are now"—"the recoil is very severe and heavy." "I object to the whole system." "Is your opinion of the weakness of the Armstrong guns solely confined to the vent-piece and the breech screw?—No, I think not; taking the gun as it stands in its best form, supposing the breech screw is strong and the vent-piece strong also, I think that a handful of dust thrown over the breech screw, at any time, would clog it so much as to render it very uncertain in screwing up." "My own impression is that the gun ought to be solid as far as possible." "I very much doubt whether the guns at present constructed could stand blows at the muzzle." Colonel Gardner says that in a trial of smooth-bore against Armstrong field guns at 800 yards, "the practice of the former was as good as the Armstrong—in fact, if I remember rightly, rather better." The sights, he thinks, "are very good; but in action they would not be attended to." "The Armstrong 110-pounder gun has twelve parts; I object to all the parts which require lubrication." "We have, in the last fortnight, destroyed the vent-pieces of five 110-pounders in the ordinary practice, and those vent-pieces had the improvement on the back." "Am I right in understanding that your chief and essential objection to the class of guns of which we have been speaking is to the principle of breech-loading?—Yes." "And that that objection, as you have stated it, may be said to be twofold, arising from the injury to the vents in breech-loading and from dirt?—Yes." "An officer in the China campaign reported:—'*On the morning of August 22, on returning to Shinho, after having bivouacked at Tangku in the rain, the breech screws were nearly completely jammed with rust; and if we had had to renew hostilities at daylight that morning, the gunners, who were already over-fatigued, would have been severely taxed in getting the guns in working order.*' When I read that, I felt confident, in my own mind, that we had got the wrong gun, because this Colonel Barry is a

very good officer, and I am perfectly sure that all proper means were taken by him to have his battery in good order; and, therefore, I think that if he made such a report as that with regard, to what occurred on the morning of August 22, the system must have been a very defective one indeed."

We might cite the evidence of many other witnesses to the same effect; but to do so would be to fatigue our readers with repetitions. No special pleading on the part of Sir William Armstrong, or his advocate in the *Times*, can rebut or alter the force of the foregoing evidence. It disposes of the Armstrong plan of breech-loading in the most conclusive way; we will add the testimony of Mr. Westley Richards, who, at No. 3,991, says, "I think any one having experience in guns would not have breeched a gun in the manner Sir W. Armstrong has done."

With reference to the Armstrong system of rifling, we allude to the breech-loaders, not to the shunt, of which we will, in our next number make special mention—it is needless to use any arguments to prove it is not his invention. The lead-coating compression system he borrowed from Wahrendorff; and the Ordnance Committee, in their Report, designate the rifling of the Armstrong guns as the "old polygroove plan."

Such is the Armstrong system, of which there is nothing original but the moveable vent-piece. All the other parts of the gun are borrowed from the ideas of different inventors; and for the most part have been used before Sir William Armstrong became an amateur artillerist. The wrought-iron coil system has been habitually in use for small arms the last forty or fifty years, and was applied to strengthen great guns before he made his first experiments. The built-up system was practised centuries ago, and renewed from time to time to the present day. The compression system of rifling by combining soft metal-coated projectiles with breech-loading, through the breech screw, is an application of other men's ideas. As to the Armstrong vent-piece, in the opinion of experienced gunmakers and practical artillerists, it is the weakest, the clumsiest, the most dangerous, and the most inefficient of all the plans of a breech-loading gun.

In reading Sir William Armstrong's prolix evidence, which takes the form of an essay on his system of artillery, in all its details, of the construction of guns and projectiles, one cannot avoid being struck by the egotistical assumptions which pervade his statements. To meet the wishes of the Government, to supply the requirements of the country, he only, in his opinion, was the person to be consulted; he only was to plan and produce the guns and projectiles of every class and denomination, which, at a time when war was imminent, might be called for. In a tone and style of language, which looks like mockery at the discomfiture of the manufacturers who were excluded from any chance of competition with Elswick, Sir William Armstrong urges as a conclusive argument that, "The Report, as you are aware, was completely in favour of the Armstrong gun and ammunition; and I really must be allowed to observe that I do not see how it possibly could be otherwise. The fact was, that no rival system of construction was brought before that Committee, therefore, on neither of those subjects could the Committee exercise any choice whatever. It may be said, that the Committee might have taken more time; and I would observe, that it would have been infinitely more satisfactory to me if more time could have been allowed to enable me to perfect all the details of the system which I had proposed. But the urgency of the case was such, that this was impossible. There was, therefore, no alternative but to decide and proceed at once."

There never was a more complete case of a man taking advantage of the wrong he has done to justify the ruinous consequences resulting from that wrong. The country was placed in jeopardy by an official combination with Sir William Armstrong, which must be regarded as a gross job; and the lamentable consequences, which flowed from it, are appealed to as a justification of the disgraceful act.

(To be continued.)

MR. CULLEY'S "HANDBOOK OF PRACTICAL TELEGRAPHY."*

It is little more than a year since, on the appearance of the first part of Mr. F. C. Webb's treatise "On Electrical Accumulation and Conduction," we had occasion to notice a really valuable contribution to that science which has given to us the "wonder-working wire," and which promises in the future to do still more in the cause of civilization and material progess. Mr. Culley's work is, perhaps, equally meritorious in a different sphere. Possessing but little claim to scientific originality or profound research, it will, nevertheless, for many years to come, remain a standard work on electro-telegraphy. At the present moment it is the *only* standard work on the subject in the English language. We may refer occasionally to the works of Highton, O'Shaughnessy, Lardner, and Walker, or to the American authors, Vail, Jones, Trumbull, and Shaffner; but none of these could we confidently recommend as a guide to those who may have to qualify themselves as efficient telegraphists. It is not alone that they lack the impress of modern improvement; for the French works of Moigno and Blavier, and the German treatise of Schellen, may also be regarded as somewhat out of date, though still accepted authorities; it is that they are wanting in the well elaborated, concisely expressed technical knowledge which distinguishes the present production of Mr. Culley, and which appears, in some measure at least, to have been derived from a careful study of the French authors, Blavier and Gavarret. But Mr. Culley has also brought to bear upon his task a tolerably extended experience, and no inconsiderable amount of native ability. In many points he is simpler, more lucid, and more concise than the foreign authorities; besides possessing the great advantage—in our eyes—of writing upon the English system of telegraphy, and, therefore, from the point of view that our telegraphic learners should evidently, if possible, obtain.

The first division of the work, "On Sources of Electricity," is the most unequally written; for, though generally accurate, and admirably adapted to the requirements of the learner, it allows of some misconceptions in relation to the "tensions" obtained by the elements of a voltaic couple, and in the definition of the "intensity" of a current. We hope to see these points more fully elucidated in a second edition of the "Handbook," and we think we see some reason to advise the author to refer to the original work of M. De la Rive, rather than to the English translation, which he appears to have consulted as an authority.

* "A Handbook of Practical Telegraphy," by R. S. Culley, Telegraphic Engineer and Superintendent. Published with the sanction of the Chairman and Directors of the Electric and International Telegraph Company. London: Longman, Green, Longman, Roberts, and Green.

After giving an instructive *resumé* of facts relating to magnetism and electro-magnetism, Mr. Culley proceeds to apply the law of Ohm to the telegraphic circuit, showing how the battery arrangements should be modified according to the resistance of the line, &c. It is wonderful to observe what has been done by the application of this law, mainly expressed —so far as it relates to ordinary problems—by a very simple formula, to divest electro-telegraphy of empiricism, and to give to it the accuracy of science. It enables the telegraphist, not only to know beforehand the exact amount of battery power required to produce signals of a certain strength at the distant station, but, as Mr. Culley shows in a great number of examples, to determine with accuracy the position and extent of any "fault" in insulation upon the line. The formula in question will be found at p. 48 of the work, and should be most carefully studied by the learner, as it constitutes the *pons asinorum* over which he must necessarily pass before he can hope to become an efficient telegraphist. The law of "derived currents" (p. 75, *et. seq.*), and its practical application, are also of the utmost importance.

In regard to the materials to be used for the insulation of overland wires, Mr. Culley gives the preference to ebonite and stoneware, either alone or in combination. Glass conducts the current to earth through the moisture which collects upon the surface of the insulator; while porcelain is liable to be under or overburnt, in which cases it is either a conductor from the first, or becomes so by reason of its porosity. These hints are well worthy of careful consideration; for, perfect as the insulation of most of our English lines may be in comparison with those of America, there is still ample room for improvement in this respect.

The chapters on "Testing for Insulation and Resistance," and "Testing for Faults," are most carefully written, and are illustrated with numerical examples by which the learner will be aided in impressing upon his memory the principles upon which the tests are founded. The latter portion of the work is devoted to the description of the Morse and Bain printing telegraphs and needle instrument, and to the "Construction of a Line of Telegraph." The Appendix contains several notes of interest and value to the student, such as the methods of constructing scales for the various descriptions of galvanometer, an account of Gaugain's "Tangent Multiplier," &c.

The work extends over 190 pages, and is illustrated with numerous diagrams and drawings. It is written—as the author remarks in his preface—in a language popular rather than scientific. Although problems relating to submarine telegraphy are, for the most part, not treated upon, it fully bears out its title as a general Handbook, and will doubtless be well appreciated by a large number of practical telegraphists in this country and its dependencies. We have every reason to congratulate Mr. Culley on his first venture as a writer upon a subject he is evidently well qualified to handle; and we look forward to the publication of a secondedition of the work, at no very distant date.

PROPOSED HIGH LEVEL BRIDGES OVER THE THAMES.

(From the *Daily News.*)

When the Select Committee of the House of Lords reported in favour of a railway which should form an "outer circle" round London, with "a bridge on the eastern side of the metropolis to connect the railways north and south

of the Thames," they must have very imperfectly considered the difficulties attending such a work. Certainly they had no evidence before them to justify such recommendations. The evidence went to show the possibility and the difficulty of passing through London, and connecting the different railways within the metropolitan circle, and it also illustrated the possibility and the difficulty of using the Thames Tunnel as a means of communication from one side of the Thames to the other. No one, however, was bold enough to propose an "outer circle" railway with "a bridge" across the navigable part of the river; nor can it be supposed for a moment that the Lords themselves knew what such recommendations would involve.

First, let us take the bridge. A bridge across the Thames is, of course, the key of such a railway. Without it an outer circle railway would only work back traffic from Blackwall on the north side of the river, round by Kensington, to Rotherhithe, on the south of the river, and *vice versa*. This it is possible to do at present by the North-London and other lines with even greater facility than an "outer circle" line could effect it. A bridge at the east of London, then, is the key of the outer circle system, without which an outer circle line must fail. Now, for the benefit of the House of Lords and of the public generally, let it be considered what such a bridge implies.

"A bridge at the eastern side of the metropolis" implies a bridge on a high level, so as not to interfere with the shipping of the Thames. It was to avoid the construction of such a bridge that Sir Isambard Brunel proposed the Thames Tunnel. So far back, then, as the time of that enterprising engineer any sort of communication, however difficult to effect, was considered preferable to a bridge. One reason for this is that the high level required (not less than 150 ft. above high water mark) must be obtained from perfectly flat shores. How is this to be accomplished? Hitherto such a work has certainly never been attempted anywhere. The high level railway bridge at Newcastle—which being above the navigable part of the Tyne was not required to be on a high level for the convenience of shipping, but only for the convenience of railway communication—starts from the summit of the high cliffs through which the river flows. The Britannia-bridge across the Menai Straits also starts from banks very much elevated by nature on either shore. But in the case of the bridge across the Thames imagined by the House of Lords an artificial access to the high level must be obtained from both shores of the river, requiring the construction of a hundred bridges, on high levels, across thoroughfares, railways, canals, rivers, and even across docks, before the level of the bridge across the Thames can be approached. It is needless to point out how much the construction of such approaches must add to the expenses of the bridge itself.

But this is far from being all. The bridge must not only be on a high level, but, to admit of the free passage of shipping, it must be of a great span. The smallest span spoken of in connection with these high level bridges is a span of 800 ft. No fixed bridge has ever been attempted by the boldest engineer with any such span as 800 ft. The only bridge in the world over which railway carriages are passed, which has a span of 800 ft., is the bridge at the Falls of Niagara, constructed by Mr. Roebling, an American engineer, on the suspension principle. But the suspension principle would be utterly inapplicable to a bridge across the Thames. A suspension-bridge oscillates with the weight of the load, and with the momentum of the carriages passing over it. No load much exceeding 300 tons has ever been conveyed, at any one time, over the Niagara suspension-bridge, and no train is allowed to pass over that bridge at a greater speed than three miles an hour. Even with these limitations the span of the Niagara suspension-bridge has been thought so dangerous that it has been practically diminished to 700 ft., by building up supports at each of its extremities.

No engineer would propose a suspension-bridge for railway purposes across the Thames; and, therefore, we may take it at once that the proposed bridge would be a fixed bridge, built upon the tubular principle, or on the lattice principle, which is a modification of it. Now the central tubes of the Britannia-bridge are each 472 ft. long. The height of these tubes is 31ft.; their width 14ft. 8 in.; their weight little less than 2,000 tons. It will be remembered that a great facility presented itself to Mr. Robert Stephenson for the erection of the Britannia-bridge. In the very centre of the Menai Straits there was a rock, called the Britannia Rock, of which he took advantage to build a pier, upon which the tubes were rested. No such favourable opportunity presents itself in the channel of the Thames. There is no favouring rock in the middle of the Thames, and to build a pier or staging from the bed of the river, in the centre of the tideway, of sufficient height to carry the works over the centre of the stream 150 ft. above high water mark, may be considered an impossibility. The bridge, therefore, must have a span from shore to shore, which implies a span of 800 ft. at the very least; and in order to be in proportion to 800 ft. in length the bridge will require to be nearly 60 ft. in height and of corresponding breadth. The weight of such a bridge could not be estimated at less than 5,000 tons; and whether such a weight could stand at a span of 800 ft., or whether a bridge with such a span would not break down of its own weight, is a question which experience at present has not determined.

One thing, however, has been determined respecting such a bridge—and that is, the difficulty of setting it up. The iron tubes of the Britannia, 470 ft. in length, were floated into the Menai Straits, and with all the advantages of that position were got into their places with extreme difficulty, and were only raised to the required levels, after six or seven weeks' hard labour, with the aid of the most powerful hydraulic machines ever employed. Now let us suppose a tube, nearly double the size of those used for the Britannia-bridge, to be constructed on the Thames, it may be at Millwall; let us suppose it safely floated to the point at which the piers for the high level bridge are to be erected on either side the Thames. How is this tube, or beam, or whatever it may be, of 800 ft. in length, and nobody knows how many thousand tons weight, to be erected 150 ft. above high water mark? Can such a work be executed without stopping the navigation of the river for a period of time which may depend on a variety of contingencies and accidents? Contractors are bold men; but is there any contractor bold enough to encounter the liability which would accrue from the stoppage of the navigation of the River Thames for a month, a week, or even for a day, during the progress of an attempt to lift a tube, or a multiplicity of beams, equal in measurement to the breadth of the river itself, to a height of 150 ft. above the river level? We say nothing of liability to accident. That is supposing an extreme case. But the question is, how a bridge is to be constructed at a height in the air of 150 ft., with a span across the river of 800 ft., and without the possibility of constructing even a staging in the centre of the river to facilitate the execution of the works?

Before considering further the question of outer circle railways dependent upon bridges over the navigable portion of the Thames, it would be well to know how such bridges admit of execution.

MEETING OF ENGINEMEN IN LEEDS.

The usual half-yearly meeting of the National Engineers' Association has been held in the large room of the Central Market Hotel, Leeds. Delegates attended from most of the manufacturing towns of Yorkshire, Lancashire, and Cheshire.

At the conclusion of the ordinary financial business of the Society, Mr. Robert Rae, of Leeds, was unanimously called to the chair. A discussion took place upon the various engineering topics of the day, and the general management and economy of steam engines and steam boilers. Amongst the inventions referred to, was a patent lubricator, by Thomas Willoughby, of Leeds; a patent sludging apparatus, by Mr. Needham, of Dukinfield; and also a steam boiler on an entirely new principle, by Mr. Elson, of Oldham. By this boiler it is proposed wholly to dispense with the present huge and ponderous vessel—containing from 10 to 12 tons of boiling water, and a pent up explosive force of from 4,000 to 5,000 tons—and to substitute a series of small bottle-shaped tubes, or cylinders, of about 240 times less capacity than the ordinary steam boiler, the requisite amount of heating surface being obtained by increasing the number of these small vessels or bottles. By a peculiar arrangement these bottles or cylinders both receive their supply of feed water and discharge their steam through the top opening or bottle neck, and thus leave the bottoms entirely free and disconnected from any other part. This has proved an efficient remedy against breaking of joints, or leakages arising from expansion and contraction. The advantages proposed to be realized by this new boiler are numerous. In the first place, it is contended that loss of life from boiler explosions may thereby be entirely prevented; for in case of any one of these tubes bursting there is not sufficient explosive matter to dislodge the brickwork or destroy the building in which they are situated. 2nd. A great economy in fuel is anticipated from the circumstance of being able to keep all the heating surface clean, and free from soot, by the application of self-acting scraping gear, and also from an increased range of expansion of steam in the engine, by being able to carry much higher pressures than are attainable with the present form of boiler. 3rd. A much diminished first cost, being at least 20 per cent. less than the present cost of boilers. 4th. A great saving of space occupied; this apparatus only occupying half the room of an ordinary boiler. 5th. Being able to carry any pressure up to 200 lbs. per square inch, with far less danger and risk than with present boilers carrying 50 lbs. per square inch, these vessels having been tested up to a pressure of 1,050 lbs. per square inch. 6th. Less loss of time by repairs, as any one vessel can easily be replaced in a few hours without taking down the brickwork. 7th. No danger of pipes breaking nor leakages through expansion and contraction, as all the tubes are loose at one end, and therefore free to expand and contract independently and separately. There is one of these new boilers now at work, and it has burst through, being short of water, with a pressure of 90 lbs. on. It did not do the slightest mischief, but suddenly stopped the engine.—Mr. Shaw, of Leeds, made an interesting and practical speech, chiefly upon boilers and their mountings, cautioning enginemen against many of the dangerous practices which they themselves are sometimes guilty of, such as hanging three or four weights, and sometimes even bricks and stones or other substances upon the levers of their safety valves, and of not opening their water gauges sometimes for two or three days together, &c.—Mr. E. Ingham, of Oldham, next addressed the meeting on the necessity of enginemen becoming better acquainted with the science and theory of their profession. In conclusion, he stated that notice had been given in the House of Commons to bring in a bill next session of Parliament, with a view, if possible, to prevent the recurrence of so many of those devastating boiler explosions which they all had to lament of late. He read letters from the framer of the bill, and from the Members of Parliament for Oldham, asking for the opinions of intelligent engineers upon the bill preparatory to its introduction in the House next session. In Lancashire they had had meetings of engineers, but not yet of the masters; and the general impression seemed to be, that in preference to Government inspection it would be better to establish local Boards in every large town, composed of gentlemen in the town, and a fair proportion of the more intelligent of the working engineers, whose election and terms of office might hereaft… be determined upon. They had (he ad… carried on a system of l… mutual insp… steam boilers in Oldh… last twe…

and during that time, although they had perhaps more boilers in Oldham than in any other town in England, they had only had one fatal explosion under their Association, and that was only attended with the loss of one life.—Addresses were also delivered by Mr. Jackson, of Leeds; Mr. Williams, of Manchester; and others; and a very interesting meeting was brought to a close by a vote of thanks to the Chairman.

DEACON'S IMPROVEMENTS IN WIND-GUARDS FOR CHIMNEYS.

MESSRS. S. AND C. DEACON, of London, builders, have recently patented the following improvements in tops, caps, and windguards for chimneys:—

Hitherto, in chimney tops, caps, and windguards formed or provided with covers at top, these covers have been fixtures, and consequently resist the ascent of the brush or cleaning instrument, from which cause damage is likely to result.

The present invention, first, consists in constructing the covers of chimney tops, caps, or windguards in such manner that the covers shall open and close—that is to say, they shall be opened by the brush or ordinary cleaning instrument when it moves upwards so as to allow such brush or instrument to pass up through the top, and shall close or return to their previous position when the said brush or instrument is lowered or withdrawn.

Various arrangements may be adopted for carrying this into effect; but the patentees prefer one or other of the following modes—in the first of which they form the cover of two flaps, lids, or doors hinged or jointed to the top, cap, or windguard, and meeting together over the top of the chimney; these doors are weighted. When the brush or ordinary cleaning instrument is driven against them, they are forced open and allow the brush or instrument to pass through; and when the brush or instrument is lowered, the doors come together again, and close over the chimney top. A convenient shape for the doors or flaps is angular, recessed, or concave, the sides forming planes inclined inwards or segments curved inwards, that is, towards the part where the doors or flaps meet.

In another arrangement, the doors or flaps are weighted and are suspended or jointed to the cap, windguard, or top, by sliding pieces sliding on rods or supports, so that the doors or flaps are free to turn or swing in either direction; the brush or ordinary cleaning instrument, when driven upwards, forces them to swing or turn outwards, and so to open and allow the brush to pass through; and they work or swing in a contrary direction or inwards when the brush or cleaning instrument is lowered, and then return to their closed or original position. Instead of weights, springs may be used in either arrangement. Guards, shields, or flaps may be jointed to the chimney caps, tops, or windguards over the slots or openings in the sides, such guards, shields, or flaps being fitted and worked as hereinafter described to open and close the said slots or openings.

The invention next relates to an improved cleaning apparatus, the object of which is to clean the inside surfaces of the guards, shields, or plates fixed outside the openings or slots of windguards, chimney tops, or caps. This cleaning apparatus consists of scrapers, brushes, or other cleaning appliances fixed to a ring, band, or frame by shanks which pass out through the said slots or openings, the ring, band, or frame being within the body of the cap, windguard, or chimney top. When the usual brush or cleaning machine is pushed up against the ring, band, or frame, the latter is forced upwards, and, of course, carries with it the scrapers or other cleansing appliances attached to it, so that these rub against and clean the inside of the guards, and when they reach the top of the slots or openings, the brush clears the ring or frame, and the latter drops to its previous position, and leaves the brush free to pass upwards. Though this frame may generally be described as annular, it need not be circular, but may be square or of other required shape, and correspond to the section or inside form of the cap, windguard, or top, and lie close round it on the inside; but it must always have a space or open way through it for the brush to pass.

DEACON'S WINDGUARDS FOR CHIMNEYS.

FIG·2 FIG·3 FIG·1

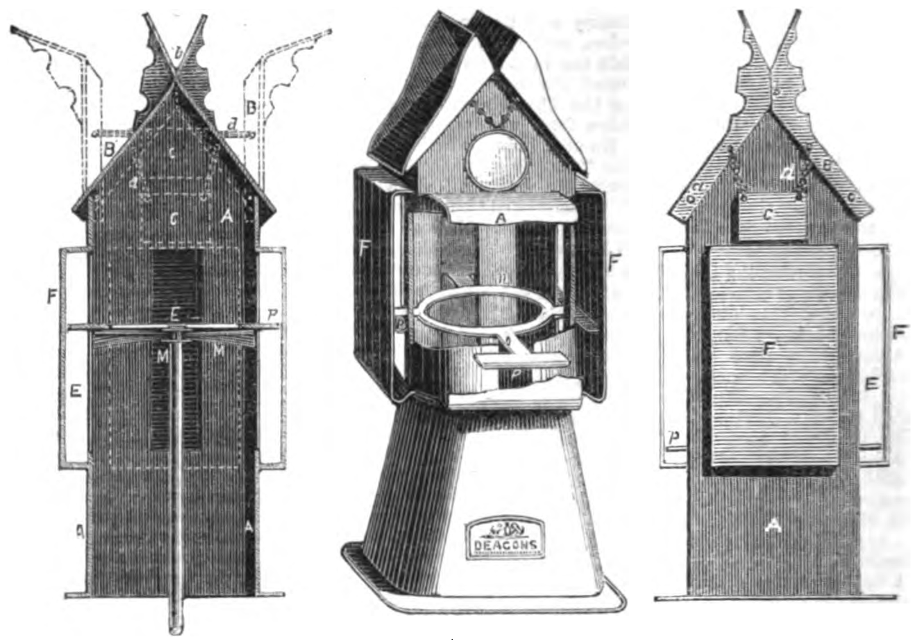


Fig. 1 is an elevation of a chimney top, cap, or windguard, having covers constructed according to this invention; and fig. 2 is a vertical section.

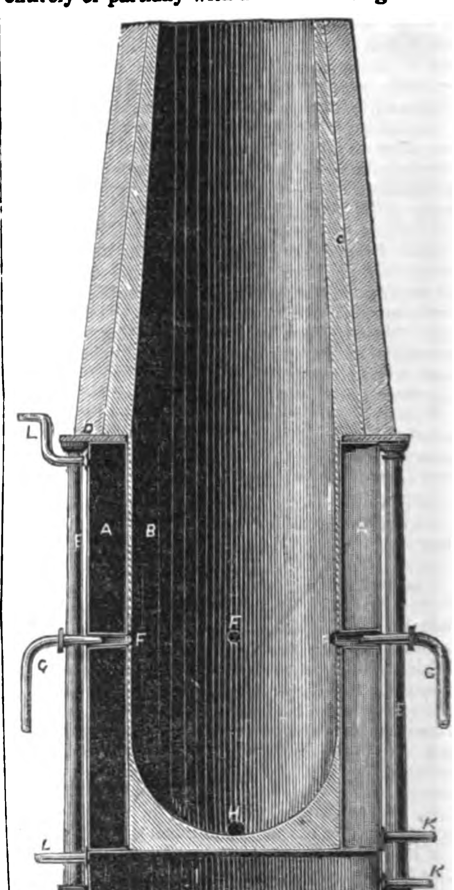
A is a top, cap, or windguard of any ordinary or desired form; B, B, is the cover, which, instead of being a fixture as heretofore, is capable of being opened and closed; it consists of two doors or flaps B, B, hinged at a to the body body of the chimney cap A, and meeting together at b; c is a weight suspended by chains d to the doors B; there is a similar weight on the opposite side. M is an ordinary brush. When the brush is pushed up, it forces the doors B open and passes freely through; when the brush is lowered and clears the doors, the latter close. Their angular shape facilitates the return of the brush.

Fig. 3 shows the improved cleaning apparatus in position within the windguard.

This apparatus consists of a ring n, on which are short shanks or projections o, having at their ends scrapers or other cleaning appliances p; the shanks o pass through the slots, wind holes, or openings F in the sides of the cap A, and the outer edges of the scrapers p extend to the guards F fixed before these openings. The ring n with its shanks and scrapers, when in the ordinary position, rests on the bottom of the guards F; and when the brush M, fig. 2, is introduced and reaches the ring n, it pushes it upwards, and the scrapers p rising with it, rub against and cleanse the inner surfaces of the guards F. When the brush has forced the ring to the top of the guards F, it clears the ring and passes through it, and the ring drops with its scrapers to its previous position at the bottom of the guards. The ring may be of any desired shape to suit the inside of the cap; and the scrapers or appliances p may be of any desired shape to suit the shape of the guards.

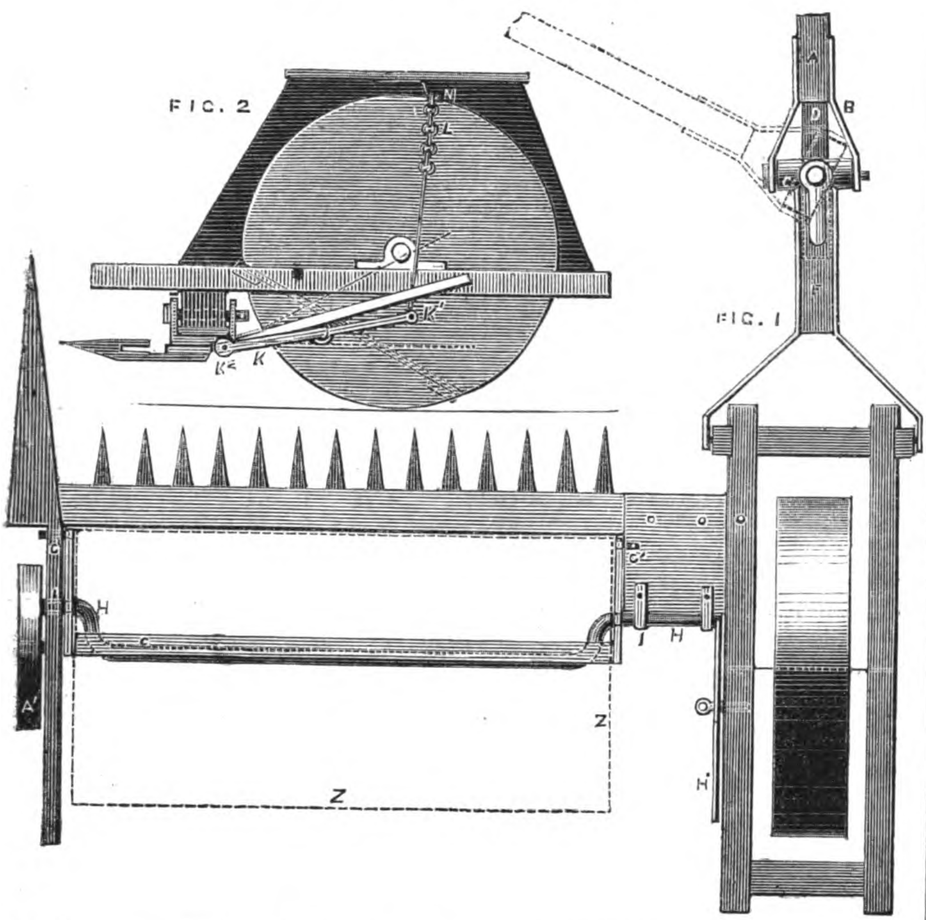
PRICE'S IMPROVEMENTS IN CUPOLAS.

THIS invention, patented by Mr. A. P. Price, of Lincoln's-inn-fields, consists in so constructing cupolas, blast furnaces, or other similar furnaces employed for the manufacture, fusion, or in the production of cast iron, steel, or other metals, and of crucibles or other similar vessels employed in the conversion or refining of cast iron in the manufacture and production of iron or steel by the injection of air or gases, or by that process known as the atmospheric process, in such a manner as that they shall be surrounded either entirely or partially with a hollow casing of cast



iron, or of malleable iron, or of other suitable metal, and shall be so constructed that a current of water, or jet of steam, or a blast of air may circulate freely through and around such hollow casing, by which means the sides of the cupola,

BAMLETT'S REAPING MACHINES.



blast furnace, crucible, or other similar converting vessel may be cooled, and the lining of the cupola, blast furnace, crucible, or other similar converting vessel may be preserved from the destructive action of the heat and the fluxes. When this casing is applied to crucibles or converting vessels used in the conversion of cast iron into steel or iron, and require to be moveable, the casing in constructed in such a manner that it shall be closed with the exception of suitable inlet and outlet pipes, so that no water, steam, or air shall escape except by such outlets when the vessel is moved for the purpose of discharging its contents. The inner surface of the casing may be lined with fire-brick or fire-clay, or any other suitable material.

A, in the engraving, is a cylindrical or other-shaped closed or open jacket of wrought or cast iron, or other suitable metal, forming, when lined with fire-clay or fire-brick B, the lower part of the cupola, blast, or smelting furnace, the jacket being, by preference, applied to that part of the furnace only where the greatest heat is generated. This jacket or casing may be formed of one or more pieces, as preferred. The furnace may be constructed and combined with the jacket in various ways. The upper part or brickwork C rests upon a stout ring or annular bed-plate D, of iron or other material, which may be itself partly supported upon the closed or open top of the jacket or casing, and partly by the outside columns E, E, or the upper part of the furnace may be entirely supported by the columns and ring or bed-plate D. F, F, are tubular openings in the jacket or casing for the reception of the nozzles of the tuyeres or blast-pipes G, G, a similar passage H being made at or near the bottom of the upper jacket or casing, or below the same, to be used as the tap hole. The base or bottom of the cupola may or may not be composed of another water-jacket I, which may be either distinct from or in one piece with the upright, or cylindrical, or other-shaped jacket or casing. In these jackets or casings a constant circulation of air, steam, or water is maintained by the inlet and outlet pipes K and L. When water is employed in a closed jacket or casing, it is preferred to bend upwards the exit pipe L, in order to ensure that the jacket or casing be constantly and perfectly full of water.

BAMLETT'S IMPROVEMENTS IN REAPING MACHINES.

THE first part of these improvements, patented by Mr. A. C. Bamlett, agricultural engineer, Ripon, Yorkshire, relates to such reaping and mowing machines as have the pole to which the horses are attached fixed to the machine by a universal joint, being designed to facilitate turning at the corners of the field and to prevent accidents, and consists in controlling the movement of the pole by means of chains or projections fixed on the pole and fore part of the frame, so as only to allow the pole to turn to about right angles with the frame of the machine or about parallel to the cutter bar.

Secondly, in order to alter the "pitch" of the ordinary platform commonly known as "Hussey's," the patentee mounts it in a frame which is jointed near the front edge of the platform. The frame is acted on by cranks, levers, or their equivalents, and by these means the pitch of the platform can be varied as required.

In the annexed drawing, fig. 1 is a plan view, and fig. 2, a side elevation of so much of a reaping machine as is required to show the mode of carrying out this invention.

A, A, is the pole, which is attached by two iron straps B and B^1 to the castor or swivelling part C, C, of the guiding wheel D. One of the iron straps B^1 has its end B^2 bent upwards, which bent part, in turning, comes in contact with the projection E (fig. 2) on the fore part of the frame F, which prevents the pole from turning any farther than is shown by the dotted lines, fig. 1, thus preventing accidents to the horses (through their feet coming on to the cutters) and making the machine easier to turn at the corners of the field, as the small wheel A^1 is pushed backwards when the horses try to turn the pole farther than is shown by the dotted lines in fig. 1.

The second part of these improvements is to readily alter the pitch of the ordinary tilting platform (commonly known as Hussey's or Dray's Hussey platform) so as the better to adapt it to long or short crops.

In figs. 1 and 2, the platform is mounted in a frame G, G, which is jointed to the machine near the front edge of the platform at G^1, G, Underneath this frame is a cranked lever H, H mounted in bearings I, I; it is capable of being raised by the lever H^1, thus altering the pitch of the platform.

A simpler method of altering the pitch o the ordinary tilting platform, and one which is easily applied to reapers that have a jointed finger bar, is shown at fig. 2. The crank lever and frame K, K, is made in one piece, which is jointed to the machine at K^2, K^2, and is held in position by a rod and chain L, L, attached to the crank lever frame at K^1 and to the hook M. By hooking the chain into different links the pitch of the platform is altered, as shown by the two single dotted lines the double dotted lines show the position of the platform when tilted, it being pivotted to the cranked lever frame as shown.

MARTIN'S NEW ANCHOR.

A NEW description of ship's anchor, invented by Mr. Martin, and ordered by the Lords Commissioners of the Admiralty (as stated) for Her Majesty's ship "Edgar," Rear Admiral Sydney Dacres, C.B., was on Saturday tested by the hydraulic machinery in Woolwich Dockyard. A number of scientific persons were present to see the working of the apparatus, for which a medal was last year awarded to Mr. Martin by the Commissioners of the International Exhibition. The weight of the anchor tested is 24 cwt. 2 qrs. 12 lbs., and that of the steadying bar 1 cwt. 2 qrs. 2 lbs. Its construction and shape in no way resemble that of any other anchor yet in use. It consists of a shank, two palmed flukes, and a sector with palms, and has no stock. Both flukes take hold of the ground at the same time, leaving no part exposed to the danger of fouling or being fouled, however shallow the soundings and anchorage may happen to be. At the test on Saturday, the tensile strain commenced at a pressure of 15 tons, which gave a deflection of one-eigth of an inch; at 20 tons of ¼ of an inch; and at 24 tons of 5-16ths of an inch, that being the required Admiralty test. The permanent set, 9 tons, gave a deflection of 3-16ths. The strain off, the anchor returned to the same point at which the pressure commenced and exhibitd no permanent deflection. The proof was pronounced thoroughly satisfactory. The anchor will be removed this morning to the smithery, and will be fire-proved—namely, heated to a low red heat, to discover if the metal is free from flaws or defects. Arrangements have been entered into to carry out the manufacture of the anchors on a large scale. For that purpose a company has been formed, of which Vice-Admiral the Hon. Sir Montague Stopford, K.C.B., is the chairman; Rear-Admiral Sir Thomas Raikes Thompson, and Rear-Admiral W. H. Hall, C.B., director of the Peninsular and Oriental Steam Navigation Company, and other influential persons, are the directors. Admiral Stopford, Mr. Martin, and various members of the company, were present at Woolwich, and witnessed the test, as also the Commodore-Superintendent, Sir F. Nicolson, C.B., Mr. Turner, master shipwright, and the principal officers of the yard.

THE SUEZ CANAL.

Advices from France state that the labours of M. Lesseps and his comrades are pursued with an activity and regularity which leave nothing to be desired, the working parties replacing each other in the cuttings without interruption. The fresh water canal rapidly advances towards Suez; and, before another year, the waters of the Nile will have been carried to the borders of the Red Sea—so at least say the engineers who conduct the works, and this with a confidence which leaves little doubt of their sincerity.

As soon as this desirable end has been accomplished, the labourers will be transferred to the more important work of excavation involved in the formation of the ship canal. One party continuing the clearing of the channel at Serapeum; another party will proceed to Port Saïd, excavating all that can be raised dry in Lakes Menzaleh and Ballah, in order to prepare the way for the steam dredges. Subsequently, M. Lesseps' little army will be wholly employed on the line from Lake Timsah to the Ameer lakes, completing that section of the canal which extends from Serapeum into the plains of Suez. In this way the waters met with in the course of the excavations will drain naturally into the Ameer lakes, in order that the greatest possible amount of work may be executed in dry cutting. The moment that matters are sufficiently advanced, MM. Duggaud Bros. will commence their labours at Port Saïd, in the construction of the necessary jetties and embankments.

The unanimous opinion of the Commissioners who have recently examined the work in all its details, is, that every portion of the canal will be completed within three years and-a-half or four years at furthest.

GREAT AMERICAN LOCOMOTIVE.

The giant anthracite coal-burning locomotive pusher, lately designed and built by Millholland, for the Philadelphia and Reading Railway, is to be used for pushing heavy coal trains between the Schuylkill river and the coal piers at Port Richmond, where there is a grade of about 34 feet to the mile for one and three-fifths miles. The following description of the dimensions of this monster pusher is from the *Railroad and Mining Register* of Philadelphia:—

Number of drivers	12
Diameter of drivers	43 inches.
Between centres of axles	3 feet 11 inches.
Wheel base	19 feet 7 inches.
Diameter of cylinder	20 inches.
Stroke of piston	26 inches.
Length of main rod	11 feet 4 inches.
Length of steam ports	18¾ inches.
Width of steam ports	1⅜ inch.
Width of exhaust ports	3¼ inches.
Lap of valve	¼ inch.
Diameter of boiler	48 inches.
Number of tubes	174
Length of tubes	13 feet 6 inches.
Diameter of tubes	2 inches.
Inside length of fire-box	9 feet.
Inside width of fire-box	42 inches.
Depth of combustion chamber	25 inches.
Total heating surface	1428 square feet.
Grate area	31¼ square feet.
Length of engine over all	36 feet.
Width of engine over all	8 feet 6 inches.
Height from rail to top of stack	14 feet.
Weight of engine	100,320 pounds.

The water tanks, three in number, are placed one on each side of fire-box beneath the foot-board, and one over top of fire-box with an aggregate capacity for 1,224 gallons. The firing, when necessary, is done at the ends of trips, no coal being carried excepting that in the fire-box. Two Giffard injectors, Nos. 9 and 10, are provided for feeding the boiler. The exhaust nozzle can be varied from 11 to 23 square inches in area. The grate bars are hollow tubes, having a circulation of water through them, James Millholland's patent. Length of grade upon which the engine operates 9,000 feet. Height per mile 34 [illegible]n *Railway Times*.

ON MAGNETO-ELECTRICITY, AND ITS APPLICATION TO LIGHTHOUSE PURPOSES.*

By F. H. Holmes, Esq.

(*Concluded from page* 866.)

Thus, then, we have a most intense light, which may be maintained for any length of time, which does not require to be trimmed or extinguished for a second, and which has all the steadiness and uniformity required for lighthouse purposes. Its advantages over the oil lamp are: first, its power can be increased *ad libitum* without increasing the size of the lens, for, if required, a machine may be made so give light enough to read by, say, at 10 or 20 miles—in fact, the light is in direct proportion to the power of the machine that produces it; secondly, its great intensity gives it a power of penetrating haze only equalled by the sun; thirdly, its whiteness distinguishes it most perfectly from all other lights on shore, which is one of its most important properties, for many a vessel has been lost for want of this property in lighthouses lighted with oil; fourthly, where coloured lights are required for the purpose of distinguishing one lighthouse from another, this light gives all the colours in a perfect manner, while the oil lamp always gives its own tinge to the colour employed; fifthly, from the facility with which this light can be extinguished in an instant, and as instantly lighted to its full power, it offers other means of distinguishing lighthouse from lighthouse which cannot be obtained with any other light. The importance of this may be understood from the fact that there are still many points around our shores that require lighthouses, but which must remain without them, till better means of distinguishing them with certainty from others in the immediate neighbourhood can be employed; for having no lighthouse is hardly worse for the navigator than having two in sight which cannot be distinguished one from the other.

An objection has been made to this light, that, being so small, it would be altogether invisible at a considerable distance; and when we merely consider that the apparent size of distant objects depends on the visual angle, there seems to be some ground for the objection; but the law of visual angles does not apply in the case of self-luminous bodies, as can be demonstrated with this piece of fine wire, which I suppose is almost invisible even with a strong light thrown on it, but now, if by passing a current of electricity through it, it is made self-luminous, it appears gradually to increase in diameter as it becomes brighter; and as a curious fact, illustrating the difference between the theorist in his study and the practical observer, a sailor who had seen the magneto-light from a great distance told me he supposed it must be at least 10 ft. in diameter. Another objection to the light is, that it is too bright; this may be an inconvenience in clear weather, but a light to be useful when most needed must be inconveniently bright in clear weather.

The last point to be considered is the cost of the magneto-electric light as compared with oil. The French Director-General of Lighthouses has made a report to his government, both as to first cost and as to cost of maintenance; both are greatly in favour of the magneto-electric light; of course in making their calculations of cost, they take the cost of an equal quantity of light in each case, that is, by oil and electricity.

I have now only to remark that this invention, if it may be called one, is purely English; Faraday commenced it when he discovered the fact that magnetism might be made to produce or induce an electric current; and although the magneto-light was first produced in Paris, it was by me; and so far from receiving assistance from any of the French *savants* in the matter, I was ridiculed by all of them for attempting what they said they could demonstrate was impossible. With regard to the regulator, which is also invented by me, there is another just invented by a Mons. Foucault, on a very different principle, but which is quite as effective, though overloaded with clockwork. His regulator has this peculiarity, it can be used in a rolling vessel, and will bear with impunity the vibrations of a steamer.

Discussion.

Mr. Lawrence suggested that Mr. Holmes should give a description of the practical arrangements of his apparatus at Dungeness lighthouse.

Mr. Holmes stated that at Dungeness, where the light had been in constant use since the 6th of June, 1862, there were in the lantern two small lenses, fixed one over the other, and two regulators to each. Only one light was shown at a time; but there were two regulators for each lens, so that an instantaneous change from one to the other could be made without extinguishing the light when fresh carbons were required. In the machine-room there were two magneto-machines, each capable of giving a powerful light, though both were in constant use. There was a distinct direct-acting steam engine attached to each machine; and there were two Cornish boilers, each capable of generating steam enough for the two engines. The material consumed at Dungeness was about 30 to 35 lbs. of coke per hour, and 5¼ in. of graphite in the regulator per hour, the price of this last being under three farthings per inch. The principal item of expense was, at present, the engineer, who had charge of the whole apparatus; but he expected that when there were several lighthouses on this principle, it would be found that one engineer would be sufficient for as many as were at present under the charge of an agent, and that none but stokers and lightkeepers would be required on the spot. The magneto-electric machines which were at Dungeness contained 120 horseshoe magnets of about 50 lbs. each, and 160 helices; but those which he now constructed contained only from 66 to 70 magnets, and from 88 to 120 helices.

The Chairman said he had listened with much pleasure to Mr. Holmes's very clear statement. He was glad to see present Dr. Gladstone, a member of the Lighthouse Commission, and he hoped that gentleman would favour the meeting with some remarks tending to illustrate this subject, which was one of national importance. It was most interesting to know that the little electric spark, not bigger than a pin's head, obtained by Faraday from the magnet not very many years ago, should have led to this development of power in the hands of an able and ingenious man like Mr. Holmes.

Mr. Summerlin referred to an invention of a somewhat similar character, by M. Berlioz, which, he believed, was superior to Mr. Holmes's apparatus. He would have been glad if Mr. Holmes had given some description of it.

Dr. Gladstone, F.R.S., said, as his name had been mentioned by the Chairman, he could not but rise to bear testimony to the able manner in which Mr. Holmes had brought forward this subject. During the existence of the Royal Commission, he had an opportunity of frequently witnessing the experiments made with this apparatus at the South Foreland. The Commissioners afterwards examined everything connected with the lighthouse system in France, where, at that time, when this brilliant light had been burning for half a year at the South Foreland, they were still making preliminary experiments, for they had not then overcome the irregularity of the current of electricity, and could not get a steady light. Since then they had advanced very rapidly, and orders had been given to place a double light of this description at Cape La Hève, near Rouen. The Dutch might perhaps be considered to have been before the French in the adoption of this system; and the Emperor of Brazil was probably before either. He did not think Mr. Holmes had exaggerated the power of this light, or the ease with which it was managed; and he was glad to be able to say this, because they knew that an inventor, justly proud of his child, was often unconciously disposed to give the best possible account of it. He was very glad to hear what Mr. Holmes had said with reference to the expense of an engineer being divided amongst several lighthouses, because that was the main difficulty. When the complexity of an instrument was increased, more skill was required in its management, and this necessarily led to expense. The great desideratum was to have a light which was capable of penetrating to great distances in misty or rainy weather, and in that respect this light was far superior to the Fresnel lamp, which was quite competent to send a light to the extreme horizon on a clear night. In a dense fog no light whatever was of any use; but a mere mist, or a shower of rain, the electric light could penetrate. There was abundant testimony that the lights at Dungeness and the South Foreland had been seen by the captains of steamers crossing from Folkestone to Boulogne, at a far greater distance than an ordinary oil lamp. Moreover, the intensity of this light could be augmented to any extent. Professor Faraday, in his reports to the Trinity House, had laid great stress upon this. All that was necessary was to double the number of magnets, and practically this was easily done, because there were duplicates of everything in such lighthouses, and in foggy

* Read before the Society of Arts, on the evening of Wednesday, December 2.

weather it was possible to bring the power of both machines to bear upon one instrument; and in that way double the intensity of light could be obtained. Then, further, supposing the fog to be so dense that no light could penetrate it, the steam engine on the premises might be employed to blow a horn or whistle, or to make some other noise which would serve as a direction to vessels. This had been pointed out by M. Regnault, Director of Lighthouses to the French Government, and was of great importance at a time when the question of fog signals was attracting so much attention.

Dr. Bachhoffner said, having been engaged in most of the patents taken out for producing the electric light, he had some little knowledge of the difficulties which had hitherto been considered almost insurmountable in producing the results which had been shown this evening. The great merit of this plan was the particular mode in which the electric light was obtained; and in this respect, as far as he had seen, M. Holmes had displayed a great amount of ingenuity. He confessed, when he first heard that Mr. Holmes had taken this matter in hand, he was very sceptical of his success; he did not believe that so much electric force could be obtained by the magneto-electric machine. The ingenuity displayed was very great, particularly in estimating the exact quantity of iron necessary for the core. Some years ago he (Dr. Bachhoffner) was engaged in some experiments on this subject, but he used iron wire instead of a hollow core. Mr. Holmes had spoken of the existence of liquid carbon between the two points, but this he (Dr. Bachhoffner) would be glad to have more evidence of. In using the electric light there was a deposit on one of the carbons, and with coke points pure graphite was produced; but he had great doubts as to the fact of liquid passing between the two points. A perfect automatic machine for regulating the position of the points was essential, and Mr. Holmes had mentioned that a spring formed part of this apparatus. He (Dr. Bachhoffner) was sorry there was any spring at all, or even clockwork. He thought a lamp might be constructed without a spring, and that would, in his opinion, make the machine perfect. The ingenuity displayed by Mr. Holmes up to this point, would, no doubt, enable him to make an improvement in this respect. With regard to the question of cost, he did not think either the oxy-hydrogen light or the electric light would ever be useful for purposes of general illumination, for in such cases the cost of the light was a most important consideration; but for lighthouse purposes this ought not to be regarded, because the matter involved the safety of human life. Nevertheless, it would be interesting to know what was the cost of this system, light for light, as compared with other methods. He congratulated the public, the seafaring portion of it in particular, upon this valuable application of electric power, which at one time he thought hardly possible of accomplishment.

Mr. Holmes said the cost of this light, compared with oil, had been gone into by M. Regnault, Director-General of Lighthouses in France, and he had calculated very fairly on the principle of light for light; and, reckoning in this way, including the expenses of alteration, taking down the large lens and putting in two smaller ones, putting up the apparatus, two steam engines complete, and the buildings to contain them, the whole of the cost was calculated at half that of an ordinary first-class lighthouse, light for light. They would quite understand the actual expense was greater than in an ordinary lighthouse; but when the quantity of light was considered, it was less by one-half, whilst the working expenses were only one-third. The light at Dungeness, he calculated, was equal in quantity to 14 of the large oil lamps with four concentric wicks. With regard to the intensity of the light, there was no form of combustion, and no chemical action which could produce a light—explosion was a different thing—beyond a certain amount of intensity. The greatest was that obtained upon lime, because the hydrogen and oxygen gases, burnt together, approached as nearly as possible to an explosion. With regard to the small size of this light, it might be argued that so small a light would become invisible at a great distance, say 30 or 40 miles. If an object 3 ft. in diameter appeared to be only an inch at the distance of a mile, what must this little point of light be at a long distance? He admitted there was something in this argument when based on the theory of the visual angle only, but it did not apply to luminous bodies. [Mr. Holmes illustrated this by showing a thin wire, which was almost invisible till rendered incandescent by a current of electricity, when its apparent diameter was greatly increased.]

The Chairman said the next duty which devolved upon him was the agreeable one of proposing a vote of thanks to Mr. Holmes for his valuable Paper. He was quite sure they had heard with satisfaction what had been stated by Dr. Gladstone, who had had opportunities of examining on a large scale the methods of illumination at present practised, and he was sure every remark from that gentleman would have great weight with those present. The power which this light possessed of penetrating to a great distance constituted its superiority to any system of lighting now in use; and it was to be borne in mind that that was dependent upon the extreme intensity of the heat evolved. It had been correctly stated by Mr. Holmes that of all the lights produced by chemical means, that of the combustion of hydrogen and oxygen gases upon a ball of lime was the most intense; but electricity was far more intense than any chemical action. By its means they could fuse the most refractory metals, and convert into vapour substances which could not be volatilized by other means. With regard to the precise condition of the carbon as it passed from point to point, there might be a difference of opinion. He thought it doubtful whether it was liquified. He could corroborate the statement of Dr. Bachhoffner as to the complete conversion of the carbon into graphite when coke was employed. Mr. Holmes was greatly to be congratulated on the manner in which he had contrived to economize the power of his currents. He had by an ingenious method detected the means of indicating the exact quantity of magnetism residual in the magnet. Another curious result which Mr. Holmes's practical experience had enabled him to effect, was the proportioning the weight of the armature to the size of the steel magnet, so as to avoid diminishing its power. This was one of the most curious results in the science of magnetism that had been produced in the course of this inquiry. An opportunity had been presented to Mr. Holmes of making experiments on a grand scale, which could not be done in the laboratory of the chemist. The practical man followed the theorist, and hence there arose a harmonious co-operation between the two in the advancement of science. He congratulated the Society upon having had so valuable a Paper brought before them.

The vote of thanks was then passed.

THE FIRST IRON-CLAD SHIP OF WAR.

In 1613, William Adams, in a letter from Japan, dated December of that year, in a mention of his voyage from Firando to Oosaka through the Inland Sea, by the Strait of Simonoseki, writes thus:—"We were two daies rowing from Firando to Facoate. About eight or tenne leagues on this side the straights of Xeminaseque we found a great towne, where there lay in a docke a juncke eight hundred or a thousand tunnes burthen, sheathed all with yron, with a guard appointed to keep her from firing and treachery. She was built in a very homely fashion much like that which describeth Noah's arke unto us. The naturals told us that she served to transport soulders to any of the Islands if rebellion or warre should happen."

PHOTOSCULPTURE.

REFERENCES from time to time have appeared in the papers respecting this novel application of photography. Preparations are being made in Paris for carrying it out on a very extensive scale. The results are stated to be very successful. The *modus operandi* will be easily understood. The sitter or object to be sculptured is placed in the centre of a well-lighted, spacious apartment; twenty-four or even a larger number of cameras are ranged in a circle around him, at equal distances from each other, with plates duly prepared, and by a simple mechanical arrangement the operator, by one movement of the hand, simultaneously uncovers all the lenses, and after a sufficient length of exposure closes them. The plates are then developed in the usual manner, a sufficient number of operations being employed for the purpose, and proofs are subsequently printed. There are thus obtained twenty-four or more views of the subject from twenty-four or more different points of sight. Each view is then in succession, by means of a magic lantern arrangement, thrown upon a screen on an enlarged scale. In order to transfer these likenesses from the photographs to the modelling clay, an instrument on the principle of the pentagraph is then made use of, having a tracer at one end and a cutting tool at the other. The lump of modelling clay is fixed on a stand capable of turning on its axis, with divisions corresponding to the number of photographs employed, and is placed in a position so that while the tracer of the pentagraph passes over the outline of the photograph thrown on the screen, the cutting tool at the other end cuts the clay into the corresponding outline. The clay is then shifted one division on its axis, and the next corresponding photograph thrown on the screen, and the operation repeated, and so on in succession till the clay has the twenty-four or more outlines accurately transferred to it. It then only remains for the artist to connect these tracings or outlines on the clay, and here, of course, his skill is shown. The artist thus has a large amount of work mechanically and rapidly prepared for him, and he is enabled, in a comparatively short time, to execute a model combining all the truthfulness of mechanism and the skill of the artist. From this model casts in plaster, or statues in marble, can be taken in the usual way. It is stated that the sculptures thus produced are remarkably good, and can be supplied at a very cheap rate, as compared with sculpture produced entirely by hand.—*Journal of the Society of Arts.*

THE LAUNCH OF THE "MINOTAUR."

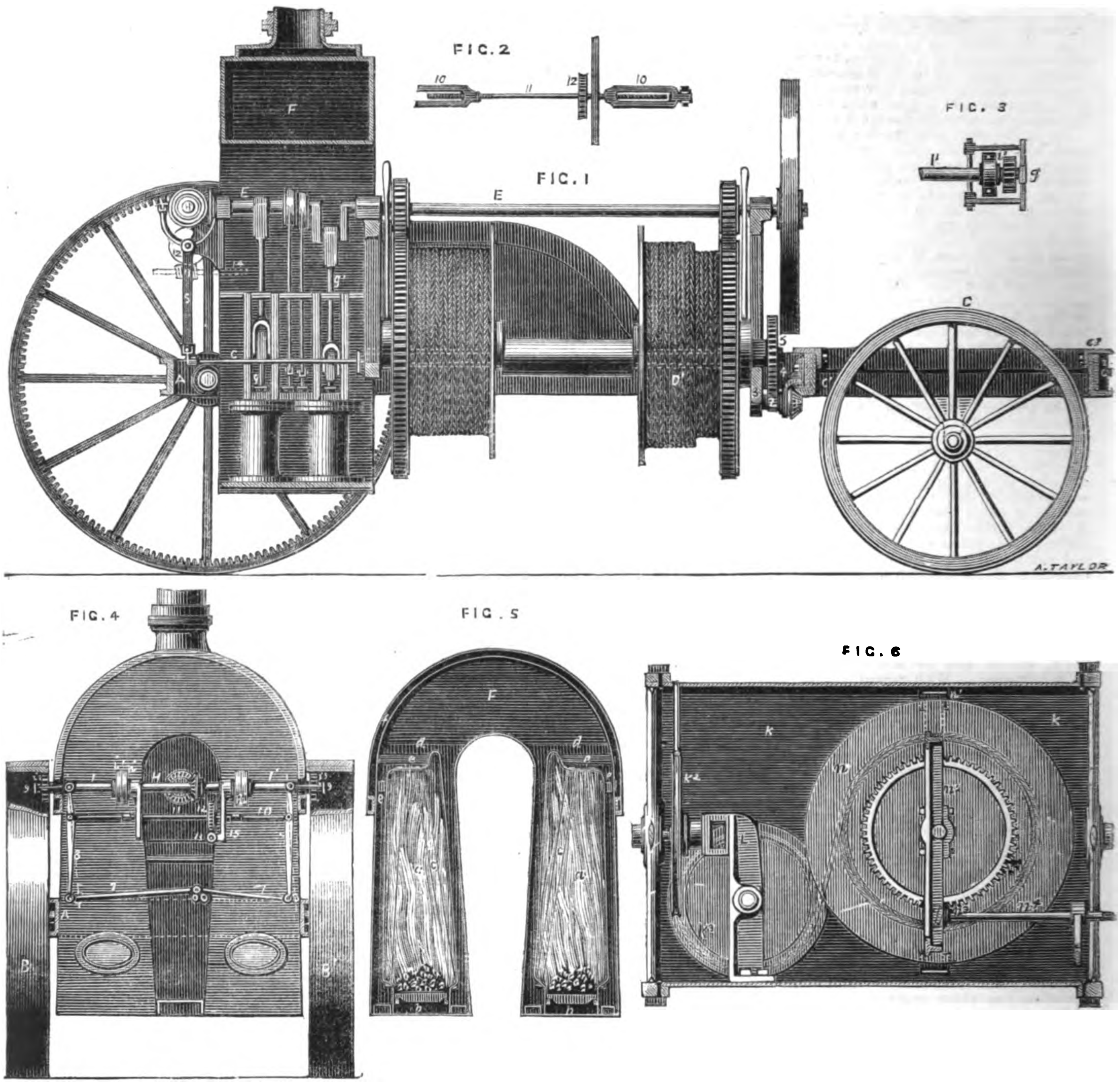
By the launch of the "Minotaur" on Saturday, our iron-clad fleet has received an important addition. This vessel, built at the yard of the Thames Shipbuilding Company at Blackwall, is the first of the largest class of armour-plated vessels, and so far as workmanship is concerned probably the most perfect of any yet afloat. Her tonnage is 6,812, builders' measurement, or 636 tons more than the "Warrior," built by the same firm. According to contract, the "Minotaur" should have been completed last May. For the delay, it is said, the Admiralty are directly to blame. Many alterations were ordered too, from time to time, which, we trust, time and experience will demonstrate to be improvements. The most important alteration was made in constructing an entirely double bottom to the ship upon the cellular system, somewhat like that of the "Great Eastern." In spite of these delays, however, considering the large size of the "Minotaur," no ship in the fleet has ever been built in so short a time; and she is a much more finished ship than the "Warrior" was at her launch. The whole of the teak backing is fastened on to her sides, and the greater part of the armour plates are fixed. The whole of the strong internal works, too, such as the compartments and the immensely strong-plated bulkheads and decks, are substantially complete.

The "Minotaur" is to have engines made by Messrs. Penn of 1,350 nominal horse power, that is, 100 higher than the "Warrior" class; and it is expected, with these superb engines, she will have a speed of at least 14 knots. The form of the "Minotaur" is very different from the "Warrior"; she is not wall-sided at any part of her lines, and when the view is taken from her bows, where she tapers finely and gradually up to her stem and swells again towards her bulwarks, nothing can be more perfect than the curves of her sides, and we should say she has the appearance of a very fast ship if her engines give her the power. The stem is made to bulge out and then in again, in the line of a swan's breast, but in form sharp as a cleaver comparatively speaking. This projecting prow is supported inside by a complicated system of cellular supports and bars, interlacing and extending back into the broader part of the ship, so as to give immense strength to this prow. Her armament will consist of 50 heavy guns, though, of course, not all 600-pounders, otherwise her armament alone would weigh above 1,000 tons, which, added to her armour which is 1,850 tons (and the weight of the empty hull is nearly 6,000 tons), would leave little for engines, rigging and masts, coal, ammunition, stores, &c. The total weight of the ship fully equipped is estimated at 10,000 tons. The following are the dimensions of the new first-rate:—

	ft.	in.
Length between perpendiculars	400	0
Breadth	59	4
Depth in hold	41	7

The launching of this immense vessel was a matter involving no small amount of practical skill and clever arrangement; yet it was accomplished with perfect ease, without a mishap of any kind. About three o'clock the last support was knocked away, Mrs. Romaine dashed a bottle of wine on the bows, named her the "Minotaur," and the mighty mass glided gracefully down the well-greased ways. Four steamers awaited her, and took her in tow, almost as soon as she was fairly afloat, towards a buoy moored below Blackwall pier. From thence she proceeds to the Victoria Docks, where the remainder of her armour will be put on, and she [illegible] her [illegible]

HOWARD, BOUSFIELD, AND PINNEY'S STEAM TILLING APPARATUS.



HOWARD, BOUSFIELD, AND PINNEY'S IMPROVEMENTS IN STEAM TILLING APPARATUS.

This invention, patented by Mr. James Howard, E. T. Bousfield, and John Pinney, engineers, Bedford, relates, firstly, to a novel arrangement of steam engine for setting in action ploughs or other implements by means of traction ropes, for the purpose of cultivating the soil.

Fig. 1, in the accompanying engravings, represents in longitudinal section the engine forming the subject of the first part of this invention; and fig. 4 is an end elevation of the same.

A, A, is the engine frame, carried by a pair of driving wheels B, B, and a steering wheel C. Upon the frame A, the barrels D,D, for carrying the traction ropes, are mounted. These barrels are driven by gearing direct from the crank shaft E, whic[h] ...tt runs longitudinally of the engine fram[e] ...passes through a divided [b]oiler F, F, s... [r]ear end of the framing, and by adopting the contrivance of eccentrics, on the axis for dropping the barrels they can be thrown in and out of gear at pleasure.

The boiler is of a vertical tubular construction, and is made of a horse-shoe or divided form to allow of the steam cylinders being placed within its lines. The two limbs or divisions of the boiler are constructed alike, as shown in the sectional elevation, fig. 5. Each part may consist of a cylindrical, or, as shown, of a rectangular tapering fire-box, the lower part of which is contracted laterally and forms the furnace. This contraction in width allows of lines of vertical water tubes, or a circle of vertical tubes *c*, *c*, being used, which pass through the fire-box and open at both ends into the water space *d*, *d*; these tubes are made slightly tapering to facilitate the circulation of the water in the boiler. To ensure the flame and heated gases circulating round the water tubes, horizontal tubular flues *e*, *e*, are introduced into the top of the fire-box. These tubes lead off the gases to the smoke-box *f*, which is an arched chamber extending from one division or limb of the boiler to the other. The steam spaces of the two divisions of the boiler are also connected together by an arched chamber, and the steam is superheated by surrounding gases on their passage to the chimney. By arranging the water tubes as explained, the sediment will fall on to the floor of the boiler, and may be readily removed through adjacent manholes. The steam is led off in any convenient way from the boiler to the cylinders G, G, which occupy the space, as before said, between the limbs or divisions of the boiler.

For making the engine self-propelling, a mitre or bevel wheel keyed on the rear end of the crank shaft gears into and drives a similar wheel keyed on a short transverse shaft H, mounted on brackets at the back of the boiler. To the extremities of this shaft friction discs or couplings are attached, such discs having, by pro-

HOWARD, BOUSFIELD, AND PINNEY'S STEAM TILLING APPARATUS.

Fig. 7.

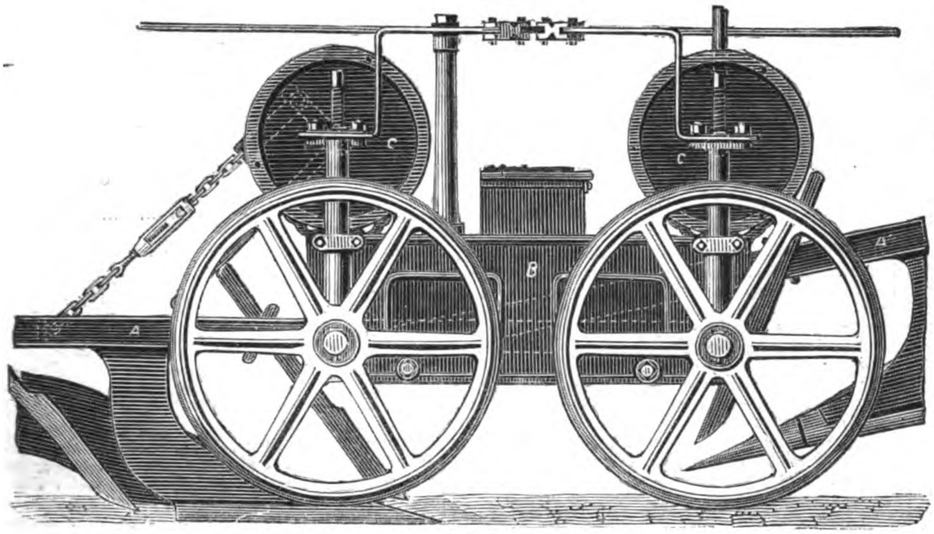
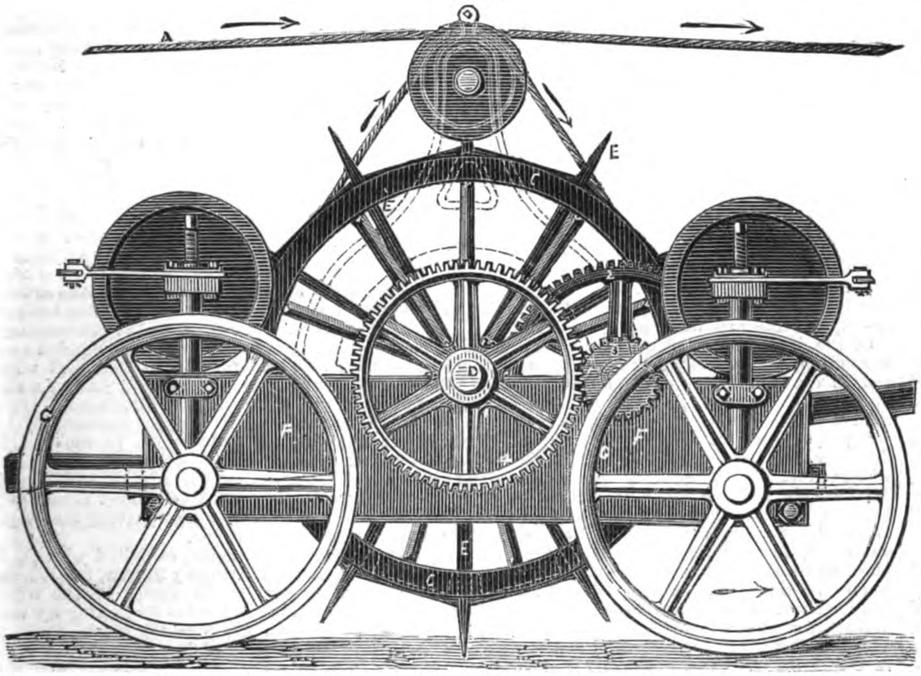


Fig. 8.



ference, annular V-shaped projections on their face. In a line with shaft this are two shafts I, I¹, carrying friction discs i, i^1, corresponding with the discs h, h^1, for establishing a connection between them and the central driven transverse shaft H. The shafts I, I¹, have an endway motion in their bearings, and they carry at their outer extremities pinions for gearing into rings of teeth on the hind carrying wheels B, B¹; or pitch chains, or other suitable modes of driving, may be employed. The natural tendency of the friction couplings will be to keep out of action, but by means of a right and left-handed screw operated by a worm and worm wheel, the shafts are pressed inwards when the carrying wheels are required to be driven, and thus through the friction couplings rotary motion is communicated from the crank shaft to the pinions in gear with the carrying wheels. This mode of actuating the driving wheels allows of their action being readily controlled by the front or steering wheel, which is operated through a segment rack and pinion or otherwise by the attendant. This rack is so coupled with the sliding shafts at the rear of the engine as by its movement to throw one or other out of action, according to the direction given to the steering wheel, by which means one of the driving wheels will remain quiescent, while the other, continuing to be driven as before, will move the engine round, the quiescent wheel being the fulcrum of the movement.

We will now describe the manner of giving an endway motion to the shafts I and I¹; and for this purpose it will be convenient first to describe the mounting of the steering wheel C. This wheel has its bearings in brackets pendent from a ring C¹ (fig. 1), which is connected to the main framing A by being embraced by the outer and inner rings C², C³, the outer ring being bolted securely to the framing. A segment rack is provided on the under side of the ring C¹, and into it gears a pinion 1 keyed to a short shaft, to which is also keyed a pinion 2. This short shaft is carried by pendent brackets. The pinion gears into a spur wheel 4, keyed to a central longitudinal shaft, which extends rearwards to the boiler, and which is coupled by gear wheels with a crank shaft 6. The cranked end of this shaft is coupled by connecting rods 7, 7, (see fig. 4), with rock levers, which extend upwards to the shafts I, I¹, respectively, and carry at their extremities a kind of saddle-piece. These saddle-pieces embrace the outer ends of the shaft, as shown best in the detached view, fig. 4, which represents the end of one shaft with its saddle-piece in plan view. To each rock lever 8 is jointed a link 10 (see the detached view, fig. 5), the inner ends of which links are tapped to receive the tapped ends of a right and left-handed horizontal screw shaft 11, by which means the two rock levers are coupled together. Keyed to the screw shaft is a worm wheel into which gears a worm carried by a shaft (see fig. 1), having a bearing in one of the brackets which support the screw shaft.

From the above description it will be understood that by turning the worm in one direction pressure may be put on the ends of the shafts I and I¹ simultaneously, and the friction discs will be coupled together, whereby a traverse motion may be given to the wheels B, B¹. If, however, the attendant turns the worm in the opposite direction he will remove the endway pressure on the shafts I, I¹, and allow the discs to be disengaged. When the apparatus is thus arranged it is ready to be acted upon by the movements of the steering wheel, thereby throwing one driving wheel into gear and the other out of gear. The steering wheel may itself be operated by the attendant through a hand lever working a pinion in gear with the segment rack on the ring C¹, and when thus operated the motion will be conveyed through the pinions 1, 2, and 4 to the the longitudinal shaft 5, thence to the crank shaft 6, and so to the rock levers 8, which rocking on the link pins as their fulcrums will throw one friction disc shaft into action, leaving the other out of action. When draught shafts are fitted to the engine for the purpose of attaching a horse thereto, the worm and worm wheel actuated by the attendant are dispensed with, the steering being then effected by the movement of the horse.

The above-described steering arrangement may be advantageously applied to road or traction engines generally.

As an improvement in the hauling apparatus for tilling land, the patentees propose, instead of employing two barrels, as above mentioned, for carrying the ropes, to use in some cases a hollow drum for carrying so much of the rope as is to be given off or taken on to produce the traverse of the implement in use, and to mount within the drum a barrel for receiving that portion of the length of the rope which is intended to be given out prior to setting the apparatus in action.

Fig. 6 is a longitudinal section of such a hollow drum fitted at its ends with spur wheels, the radial arms of which carry the trunnions for supporting the drum. Within the drum are mounted sheaves k, k^1, and k^2, supported by the framing l, which is bolted to the drum. These sheaves are for guiding the traction rope m to and from the barrel n, to which one end of the rope is secured. This barrel is mounted in frames n^1 bolted to the inner periphery of the drum. To allow of the rope entering and leaving the interior, a segment slot is cut in the drum, as shown in fig. 6. On the axle of the barrel n is a worm wheel, into which works a worm, carried by a shaft. This shaft extends through the end of the drum, and is squared at its outer extremity to receive a key for rotating the shaft and worm, and thereby moving round the barrel n when required. The normal state of this internal barrel is to be locked, which is effectually done by the interlocking of the worm and worm wheel. One end of the rope being fixed to the periphery of the drum K, a portion equal to the length of traverse of the tilling implement is wound upon the drum when the apparatus is to be brought into action; another portion is passed round the field; and the remainder through the opening made in the periphery of the drum to the barrel n, it being guided by the sheaves on to the inner barrel and wound thereon. When this windlass is first brought on to the field, it is necessary, in order to attach the rope to the cultivating implement and pass it round the anchors, to run off the required length of rope from the inner barrel, the portion of rope on the drum being used for the purpose of giving out in compensation for

the portion of rope which it winds on while effecting the traverse of the implement. For taking up any slack, the inner barrel is rotated by the attendant, who, by reversing the motion, can run out any required amount of rope to suit the dimensions of the field under cultivation.

This invention also relates to certain improvements in the ploughs or tilling implements to be used in steam cultivation. Instead of connecting the two sets of frames of double-action ploughs as heretofore by means of tie rods, chains, or springs, the patentees arrange these frames so that each set of tilling instruments is raised out of work or lowered into work independently of the other.

Fig. 7 represents in side elevation a portion of a double-action plough constructed according to this part of the invention.

A, A1, are the rocking frames, to which are affixed the two sets of ploughs, which act alternately upon the land and are alternately lifted out of the ground at the completion of a "bout." B, B, is the plough carriage, upon which are fixed two pairs of spring boxes C, C. Each of these boxes contains a coiled spring D, one end of which is secured to the fixed box, and the other to a disc E contained in the box and keyed fast to a cross shaft F. The spring boxes are connected in pairs by means of the cross shafts F, to which are affixed lever arms G, G, and a hand lever H. The frames are permanently connected to their respective spring boxes by means of coupling chains I, the ends of which are secured respectively to the rocking frames, and through cranked links to the arms G, G. The object of the springs is to give the cross shafts a tendency to rotate and wind up the coupling chains I, I, and thus to assist in hoisting the ploughs clear of the ground at the completion of a "bout." Suppose, now, the set of ploughs attached to the frame A to have completed a "bout," the attendant who has been riding upon the depressed plough frame leaves his seat, and, by lifting the extremity of the frame, is enabled, with the assistance of the coiled springs, easily to raise the set of ploughs clear of the ground. By the mode adopted of coupling the chains to the rocking shaft the raised ploughs will be effectually locked in the raised position, and will have no tendency to fall until the attendant pulls over the hand lever H and throws the lever arms G, G, over their dead centre. To prevent the raised ploughs from falling by reason of a sudden shock (produced by the implement working in very rough ground) check chains K, K, pendent from the shafts F, are provided, which are or may be hooked to the suspended frame.

Another improvement in double-action ploughs and other implements relates to the adaptation thereto of the light or fly-rope system. To this end the patentees apply a second motion shaft to, or connect the same with, the steam engine intended to be used for driving the implements, and mount thereon a grooved pulley, round which the endless hemp or light rope passes to a corresponding grooved pulley on the frame of the implement to which the power is to be transmitted. This second motion shaft is intended to increase the speed of the fly rope, and thus impart a proper speed to the implement.

Fig. 8 shows a tilling implement fitted to receive the fly rope and be driven thereby.

A is the fly rope; B the grooved pulley round which it passes to a large pulley C, running loosely on the shaft D of the propelling wheel E. This propelling wheel is fitted at its periphery with blades which bite the ground, and by the revolution of the wheel in either direction ensure a forward or backward motion, as the case may be, to the implement. The plough carriage F is supported by carrying wheels G, and the shaft D of the propelling wheels is mounted in the middle of the carriage. The revolution of the pulley C is transmitted to the propelling wheel by the following arrangement of spur gearing:—Affixed to the pulley C is a pinion 1, which gears into a spur wheel 2, on the shaft of which is keyed a pinion 3. This pinion gears into a spur wheel 4, on the axle of the propelling wheel, and thus the rapid motion derived from the fly rope is reduced in its transmission to the propelling wheel to such an extent as will ensure the requisite speed of traverse to the implement. The engine may either be stationary, and the ropes passed around the field by means of pulleys and anchors, or the engine may advance on the headland opposite to the work, the rope passing only across the field in a line with the work itself. The slack of the endless rope may be taken up by a weighted roller.

ON THE LOCOMOTIVE ENGINES IN THE INTERNATIONAL EXHIBITION OF 1862.*

By D. K. CLARK, C.E.

THE collection of locomotive engines shown in the International Exhibition of 1862 may be adopted as a fair average exponent of the best and most recent practice both English and foreign, particularly the former. The English engines were mainly examples of the standard classes in general use on the principal English railways. The foreign locomotives showed greater variety, boldness, and originality of design, and were mainly constructed for lines with very heavy gradients and sharp curves, which are generally associated together in mountainous districts, causing special mechanical difficulties not applying to the general circumstances of the English railways.

Twenty engines altogether were exhibited, of which eleven were contributed from the United Kingdom, three from France, one from Belgium, two from Austria, one from Prussia, one from Saxony, and one from Italy. Of the above twenty engines, fourteen had outside cylinders, and six had inside cylinders; and of the eleven English engines, seven had outside cylinders and four had inside cylinders. Most of the engines were specially constructed for burning coal: a feature which has been introduced entirely since the former Exhibition of 1851, on account of the smaller cost of coal for fuel compared with coke.

English Locomotives.—Amongst the English locomotives may be noticed first, as specimens of the largest class of express engines, two exhibited and manufactured by the London and North-Western Railway, one with inside and the other with outside cylinders, but both with 7 ft. 6 in. driving wheels, and designed with special regard to the running of the express trains on that line.

Of the inside cylinder class only three engines were made, as it was found to be heavy on the road and in consumption of fuel. It is an engine of maximum dimensions, and indeed must be considered beyond the capacity of the narrow gauge for proper working. With cylinders of 18 in. diameter and a stroke of 24 in., 7 ft. 6 in. driving wheels, and 26 square feet of grate, it weighs 34½ tons in working order, of which there are 14½ tons on the single pair of driving wheels. With the tender, weighing 25 tons with fuel and water, the total weight to be moved amounts to about 60 tons, exclusive of the train. The boiler has been designed for burning coal, with a combustion chamber and a double compartment of the fire-box for alternate firing, to which have been added fire-brick arches inside and deflecting plates in the doorways. The grate is 7 ft. long in two parallel strips, and the enormous amount of 242 square feet of heating surface has thus been attained in the fire-box and the combustion chamber; making the "direct" heating surface greater than has before been attained on the narrow gauge. But the advantage of "direct" surface, or that which is exposed to the radiant heat of the fire, depends upon its being within a reasonable distance of the grate; whereas in this fire-box the crown is 6 ft. 3 in. above the grate, and the upper portions of the surface are therefore nearly ineffective for evaporation. This great extension of fire-box and combustion chamber has led to the curtailment of the tubes to 9 ft. 4 in. length, and it has been attempted to compensate for this by packing 214 tubes together at ·50 in. distance apart, making 980 square feet of heating surface in the tubes. The opinion has been extensively held that heating surface is mechanically the equivalent of evaporating power, but this in the writer's opinion has not been confirmed by practice; for besides surface, circulation is wanted; the circulation of the water to the tubes, and of the steam from amongst them: and in this particular engine the evaporative power of a smaller number of tubes placed at ·75 in. apart would have been greater than that of the tubes as they are. The driving and leading springs are connected by a compensating beam, which seems likely to give an unsafe freedom of action to the engine at high speeds.

The outside cylinder engine, exhibited by the London and North-Western Railway, is one of a numerous class running the express trains on that line, and contrasts in several respects with the inside cylinder engine. It weighs only 27 tons in working order, and the tender 17½ tons, making a total of 44½ tons, as against 60 tons for the other engine; and the weight on the driving wheels is only 11½ tons instead of 14½ tons. The weights on the several wheels are—

	Inside cylinder engine.		Outside cylinder engine.	
Leading wheels...	11·90 tons	...	... 9·40	tons.
Driving wheels ...	11·30 ,,	...	... 11·50	,,
Trailing wheels...	18·50 ,,	...	... 6·10	,,
Total weight	34·70 ,,	...	... 27·00	,,

The fire-box is of the ordinary form, with little more than half the grate surface of the other engine; and it is fitted for coal burning with a fire-brick arch and two air openings in front, closed by a regulating flap. The heating surface of the fire-box is 85 square feet, being little more than one-third that of the inside cylinder engine; and there are fewer tubes, but then they are ·62 in. apart. The other engine gains the advantage in the greater size of blast orifice, which is 5¼ in. diameter for the inside cylinder engine, and 4½ in. for the outside cylinder engine; owing to the larger area of grate in the former engine, which does not require the same sharpness of blast to draw the air through.

Regarding the engines as carriages, the height of the centre of the boiler in the inside cylinder engine, 7 ft. 5½ in. above the level of the rails, is considerable, and tells upon the rails when the engine sways. In the outside cylinder engine, though the driving wheels are as large, the centre of the boiler is 11 in. lower; and this in connection with a compact wheel base and a balanced driving wheel, produces a safe, steady, and easy-running engine. In both the engines feed-pumps are displaced by two Giffard's injectors.

The outside cylinder engine is fitted with a duplex direct-action safety valve, in which a pair of valves are pressed down by a cross-bar with a spiral spring attached to the bar midway between the two valves—a decidedly superior arrangement to the ordinary weighted lever, since this valve cannot be tampered with, and is much more prompt in discharging an excess of steam, as it opens wider for a given excess of pressure. The smoke-box is furnished with a descending hopper at the bottom, having a small opening not closed, through which ashes and ignited cinders are allowed to escape constantly; thus overheating of the smoke-box is prevented. The reversing gear is worked by a screw and hand-wheel, instead of the usual long lever and notched sector; this reversing gear, which is applied to nearly 200 engines, is more easily worked, saving the engine-man a great deal of fatigue.

The tender of this engine, exhibited with it, has six wheels, and weighs empty 9½ tons, full 17½ tons, the load being equally distributed on the wheels. It is fitted with the apparatus for picking up water whilst running—a scoop is let down from the bottom of the tender, and dips into the water contained in a long open trough between the rails, from which it is made to flow up the scoop into the tender tank by the motion of the tender in running. A minimum speed of more than 15 miles per hour is required for this operation. Three of these water troughs have now been laid down and are in use in different situations on the London and North-Western Railway; and their advantages are that the size and weight of the tender for running a given distance may be reduced, the number of stoppages lessened, and time saved. An express engine has thus been enabled to run the whole distance from Holyhead to Stafford, 130½ miles, in one continuous run, without a single stoppage, at an average speed of 54½ miles per hour.

The next engine to be noticed is a passenger express engine, for the South-Eastern Railway of Portugal, 5 ft. 5¾ in. gauge, exhibited and manufactured by Messrs. Beyer Peacock and Co., whose design is characterized by elegance, thoroughness, and finish, in form, arrangement, and detail. This engine is a type of the prevalent style of English inside cylinder express engines. The framing is composed of two pairs of longitudinal bars or slabs running straight from end to end, cross-braced by the cylinders, the footplate, and various cross plates. The extension alongside the fire-box of the two inside longitudinal slabs, which stopped short in front of it in the earlier examples of this description of frame, is a great improvement

* Read before the Association of Mechanical Engineers.

in practice, as it connects the steam cylinders, driving axle, and drawplate, directly and immoveably together, and bears the entire strain of the steam in the cylinders, and transmits the tractive force to the train. The boiler is thus relieved of all strain from the working parts, from which formerly it was not free, and then suffered accordingly. The driving axle is made with only two bearings, inside the wheels, for which the guards are forged on the inside frame plate, and the leading and trailing wheels have their bearings outside the wheels; an arrangement originated by the late Mr. John Gray, and now generally adopted for its simplicity, and for the greater firmness of the frame and the increased duration of the crank axle. The steam strain is, in fact, confined to the two inside frame plates, and to the inside bearings of the crank axle, close to the cranks. The leading and trailing wheels are 3 ft. 9 in. diameter, the driving wheels being 7 ft.: the leading wheels have been thought rather too small, and no doubt there is space in the engine for enlarging them; but they would have departed from uniformity with the six tender wheels, which also are 3 ft. 9 in. diameter.

The short cast-iron blast-pipe reaching just above the level of the upper row of the tubes is to be remarked. This level of blast orifice has been found to give the best results, creating a better draught with a wider orifice, as compared with higher blast pipes; and was arrived at by Mr. Peacock, by means of a series of well arranged experiments on the Manchester, Sheffield, and Lincolnshire Railway: the low blast-pipe is now generally employed. The early blast-pipes were carried some distance into the chimney, and had very contracted orifices, and a sharp blast with much back pressure on the piston was the consequence.

The boiler, in consequence of the greater width of the Portuguese gauge, 5 ft. 5¼ in., has a large square fire-box, 4 ft. 10 in. each way over the outside shell, and has a large diameter of barrel, 4 ft. 2 in., which gives abundance of steam and water space. Nevertheless, for effective heating surface, a fire-box of oblong form would, in the writer's opinion, be better. There are 215 tubes of 2 in. diameter placed at ·56 in. apart: had the tubes been only 1⅞ in. diameter, which, upon the whole, the writer considers the best size, and placed in the same position, the larger clearance of ·69 in. so obtained for circulation, would have improved the evaporative efficiency. The fire-box is adapted for coal burning with a fire-brick arch, a deflector plate from the doorway, and sliding fire-doors, on the plan in use on the Midland Railway.

A passenger express engine for the Caledonian Railway, exhibited and manufactured by Messrs. Neilson and Co., is a specimen of the class of engines extensively used on that line, which were designed with a view to economy rather than speed, although a very large driving wheel is used; they are employed on main line service between Glasgow and Carlisle, taking their turn with all trians, fast and ordinary. From the experience that had previously been acquired of the durability and general economy of the 7 ft. driving wheels over the original 6 ft. wheel passenger engines of the line, it was supposed that a further extension of the principle of enlarging the driving wheel would be advantageous; and the extreme size of 8 ft. 2in. diameter has been adopted for trial in the class of engines exhibited: but it may be questioned whether this has not been carried too far. The cylinders are 17¼ in. diameter and 24 in. stroke. This engine has grown out of the old Crewe pattern of engine, originally introduced on the Caledonian line by the late Mr. Locke, the chief engineer, and successively modified to meet the growing requirements of the traffic. The engine weighs in working order 30¾ tons, of which the driving weight amounts to 14½ tons. This driving weight is considerably in excess of any other among the engines exhibited, except that of the North-Western inside cylinder engine; but no doubt the large size of the driving wheels, 8 ft. 2 in. diameter, reduces in some degree the injurious effects of so great a concentrated load on the permanent way. The counterweights are compactly forged into the rims of the wheels, extending over one-third of the circumference; and though a little more weight is thus requisite to complete the balance, it sweeps gently over the rails when the engine is in motion, without the sledge-hammer effect of a revolving cubical mass compressed into the space between two or three spokes. For such a large wheel also the spokes are planted thickly, at 10 in. centre to centre on the rim: the stiffness of a spoke decreases in a rapid proportion with its length, diminishing as the cube of the length, so that a spoke of an 8 ft. wheel will be only about half as stiff as a spoke of the same scantling for a 7 ft. wheel. The driving axle is of cast steel, and the tyres are of Krupp's steel.

The framing of the old Crewe engine is retained in this one, giving outside bearings to the fore and hind axles, and inside bearings to the driving axle.

In this respect, the North-Western outside cylinder engine, already described, is at variance with the older practice, having but one longitudinal frame-plate on each side, with inside bearings for all the wheels. It may very properly become a question whether the cylinders should be so rigidly united as they are in the Caledonian engine to the outside frame-plates, which carry two pairs of wheels and axles, and, of course, transmit the shocks of the road to the cylinders. The foot-plate is provided with a housing for the engineman and stoker—a most important provision for their comfort, and, consequently, for the safety of railway trains. Plain-fence plates or weatherboards across the back of the fire-box are now commonly applied to engines, and these are useful; but the housing is certainly better, and it seems strange that the adoption of so desirable a protection should have been so long neglected.

The slide valves are made with 1⅛ in. lap at each end, according to the proportion originally arrived at by Mr. Sinclair on the Caledonian Railway, from finding the peculiar importance of long lap and long travel for the valves of outside cylinders. The long lap and long travel of the valves, unquestionably facilitate the free exhaust of the steam at high speeds from exposed cylinders, in which the steam is more or less partially condensed: and moist steam being not so active as dry steam, exerts an excessive back pressure on the piston, if not freely discharged.

The boiler is fitted with the fire-brick arch and door deflector previously referred to for burning coal; the barrel is 3 ft. 10 in. diameter, and contains 192 tubes of 1⅞ in. diameter, placed with ·62 in. clearance between them. Giffard's injectors are employed. The consumption of coal by these engines is stated to average 23 lbs. per mile, with trains of nine heavy carriages and a speed of 35 to 40 miles an hour; and they take fourteen loaded carriages up the Beattock incline, an average rise of 1 in 78 for 10 miles, at a speed of 30 miles an hour.

The goods engine for the London, Chatham and Dover Railway, exhibited and manufactured by Messrs. Sharp, Stewart, and Co., is a first-rate six-coupled-wheel engine, with 5 ft. wheels and 17 in. cylinders of maximum power, adapted for the heavy loads, heavy gradients, and the high speeds ultimately intended on that line. It is a fine engine, of excellent workmanship and proportions. It weighs empty 28¼ tons, full 32 tons; and the weight is nearly equally distributed over the three axles, to the advantage of the permanent way, so that the load on any one axle does not vary more than ¾ ton from the average load on all the axles, the loads being as follows:—

Leading wheels	10·65 tons.
Middle wheels	11·55 „
Trailing wheels	9·85 „
Total weight ...	32·05 „

The fire-box is 8 ft. long externally, with an inclined grate, on the South-Eastern Railway plan, for burning coal, which give a longitudinal section and sectional plan of the fire-box. The hind axle is thus brought under the fire-box about one-third of the length, and is enabled to take its proper share of the load; whilst the length of wheel base is moderated, and is bisected by the middle axle: advantages peculiar to this plan of fire-box. The fire-box measures 7 ft. 3 in. long inside, divided longitudinally by a midfeather, and has 27¼ square feet of grate. There are 189 tubes, 2 in. diameter, with ·62 in. clearance, within a 4 ft. 2 in. barrel. These are good proportions, according to current practice; but had there been only 160 tubes with ·75 in. clearance, in such a large barrel, it would, in the writer's opinion, have been decidedly better. The boiler is fitted with Giffard's injector. The housing for the engineman, with windows in the front and sides, is very good and complete.

The frame is composed of four longitudinal plates, carried from end to end, with suitable cross-plates to bind them. The outer plates are each of one slab, combining great strength and lightness; the usual construction of outer frame with double plates and timber packing has thus been superseded in this engine. The driving axle has four bearings, two inside and two outside, and the extreme axles have only outside bearings; and the old antagonistic action is set up, arising out of the unequal wear of the inside and outside bearings; the inside bearings next the cranks, receiving the full strain of the steam, will wear faster than the outside bearings, leaving the cranks unsupported, and shortening the duration of the axle; overstraining in that way also the connections of the inner and outer frame-plates, and thereby loosening them. On the other hand, this arrangement admits of large outside bearings and capacious axle-boxes for all the axles; an advantage which, unfortunately, the narrow gauge does not permit for inside crank-axle bearings. The drawing tackle of this engine is connected exclusively to the frame, and kept quite independent of the fire-box.

The valve gear is very substantially and firmly arranged: the expansion link is shifted, and the slide block is not overhung, but hung between the ends of the link which carries it. This engine is stated to be capable, with a working pressure of 120 lbs. per square inch, of taking a load of 480 tons on a level at 20 miles an hour, or a load of 250 tons up a gradient of 1 in 100 at 15 miles an hour.

A six-wheel-coupled goods engine, of excellent workmanship for the Midland Railway, was exhibited and manufactured by Messrs. W. Fairbairn and Sons. It has the ordinary rectangular fire-box with 14½ square feet of grate, and is fitted on the Midland plan, already referred to, for burning coal. The cylinders are 16 in. diameter with 24 in. stroke. The engine weighs in working order 32¼ tons, and is a thoroughly good engine of its kind; it is a type of the powerful goods engine usually met with on the old main lines of railway, and may be usefully compared with the Chatham and Dover goods engine last described, which is an engine of the same weight and power, but of a different and more recent class. In the first place, the weight is not so well distributed on the wheels of the Midland engine, being considerably in excess on the leading wheels, the loads being as follows:—

	Midland engine.		Chatham and Dover engine.
Leading wheels...	12·30 tons	... ...	10·65 tons.
Middle wheels ...	11·25 „	... ...	11·55 „
Trailing wheels...	8·70 „	... ...	9·85 „
Total weight...	32·25 „	... ...	32·05 „

showing in the former engine 3½ tons more load on the leading wheels than on the trailing, and in the latter only ¾ ton more; while the wheel base of the former engine is 16 ft. 6 in., or 1 ft. more than that of the latter, as the vertical fire-box of the former keeps back the hind axle. The frame of the Midland engine, like that of the other, has four longitudinal plates, with four bearings to the driving axle and outside bearings to the other axles; but the inside frame plates stop short at the fire-box, and are fastened to it by sliding joints, allowing for expansion of the boiler. The draw-plates are rivetted to and across the back of the fire-box, from which the whole of the drag is taken; and therefore, as the tractive force must be transmitted from the outside frame plates to the fire-box, they are very strongly united to it by brackets for that purpose. Thus the whole area of the frame behind the fire-box remains unemployed except as standing ground. This is, in the writer's opinion, an objectionable feature in the engine, without any countervailing advantage. Not only is the steam power transmitted circuitously, tending to over-strain and buckle the framing; but it arbitrarily subjects the boiler, already highly strained, to a great and unnecessary additional strain, which is now beneficially avoided in the other arrangements of the framing as already described.

The boiler tubes are well designed, being 2 in. diameter, 180 in number, and placed with ·62 in. clearance, in vertical rows; which accounts for the high character of these engines for keeping up the steam. The boiler is put together without angle iron, the plates being flanged at the end; the steam dome also is flanged and formed in one piece. For this purpose thick-edged plates are used, rolled to ⅝ in. or ¾ in. thick at the edge, to allow material to work upon in flanging. The advantages claimed for the thick-edged plates in their application are that they save a joint, including a row of rivets, and are stronger than angle-iron joints; and that the joints are cheaper and easier to make, and are not subject to grooving by corrosion. The dome joints being faced in the lathe, bad joints are prevented.

Of the mixed engines a six-wheeled four-coupled engine for the East Indian Railway, of 5 ft. 6 in. gauge, was exhibited and manufactured by Sir W. G. Armstrong and Co., with outside cylinders and the hind wheels coupled. The wide Indian gauge of rails, 5 ft. 6 in., admits of a large fire-box 4 ft. 1½ in. square inside, with a grate of 17 square feet, which appears too large for the cylinders of 16in.

diameter and 22in. stroke, and the wheels of 5ft. 7in. diameter. The boiler tubes, 157 in number, are 10ft. 11 in. long, 2¼ in. outside diameter, and they clear one another by ·56 in. These proportions would, in the writer's opinion, be improved by reducing the tubes to 2 in. diameter with increased clearance; and the reduction of heating surface would be amply compensated by the increased facility for circulation of the water and steam between the tubes.

The total weight of the engine in working order is 32¾ tons, which is too great for such an engine; 21¼ tons are available for adhesion, but very unequally divided between the wheels, the respective weights being—

Leading wheels	11·47	tons
Middle wheels	12·55	„
Trailing wheels	8·67	„
Total weight...	32·69	„

The leading wheels are 3 ft. 7 in. diameter, and the six wheels of the tender are 3 ft. 9 in. diameter, only 2 in. difference in size.

The slide valves have only ⅞ in. lap, but this is inadequate for a 16 in. outside cylinder, in which there is always more or less condensation of steam. The back pressure on the piston at high speeds must be considerable, as an insufficient lap prevents a full and free opening to the exhaust, which is required to be greater for moist than for dry steam. The foot-plate is furnished with an awning frame, to protect the engineman completely from the sun and to ensure ample ventilation: an object of vital importance in India. It is a very complete screen, the use of a weatherboard being unfavourable for ventilation.

A mixed engine was exhibited by the Great Eastern Railway, manufactured by Messrs. Robert Stephenson and Co., with six wheels, four coupled, and outside cylinders. The framing has but one longitudinal plate on each side from end to end, with inside bearings for all the wheels. With 17 in. cylinders and 6 ft. 1 in. driving wheels, which are more powerful than in the East Indian engine, the boiler is lighter, having only 13¼ square feet of grate instead of 17 square feet, with a shallower fire-box and a smaller barrel. Hence the total weight of the engine is less, and the weight is more equally distributed on the wheels, the loads being

Leading wheels	11·10	tons.
Middle wheels	10·70	„
Trailing wheels	10·05	„
Total weight ...	31·85	„

The leading wheels of 3 ft. 7 in. diameter are also very properly made uniform with the six tender wheels. The engine is reported to have run 45,000 miles without repairs; for which satisfactory result it is indebted to excellent design and workmanship, and no doubt also to the favourable distribution of the weight, and to the material of the tyres, Krupp's steel, which were apparently very little worn. A pair of tyres which had run 68,000 miles showed a wear of only about ¼ in. on the tread. Several of the driving and trailing wheel tyres of engines of the same class have run 60,000 to 70,000 miles without re-turning. The duration of these steel tyres is estimated at 100,000 miles on the leading wheels, and 150,000 miles on the middle and trailing wheels; but none have yet been worn out.

The barrel of the boiler is 3 ft. 10 in. diameter, and has 192 tubes, 1⅞ in. diameter, with ·62 in. clearance; which are fair proportions. The fire-box is fitted for burning coal, with a door deflector and jets of steam from the sides of the fire-box. The slide valves have 1¼ in. lap, with 5½ in. travel in full gear: very suitable proportions for outside cylinders, as before observed, for quick running and free exhaust.

Engines of this class are stated to work passenger trains averaging 16½ carriages, maximum load 35 carriages, at an average speed of 25 miles an hour, consuming 25 lbs. of coal per train mile; and goods trains consisting of 35 waggons, gross weight 300 tons, at an average speed of 20 miles an hour, consuming 30 lbs. of coal per train mile.

Of the tank locomotives the largest is that exhibited and manufactured by Messrs. G. England and Co., weighing 17 tons in working trim. It was designed for branch lines, and has six wheels with a 10 ft. wheel base, four coupled wheels of 4 ft. diameter, and cylinders 11 in. diameter. It is neatly arranged, with two tanks to hold 520 gallons very conveniently placed on the foot-plate, one on each side, enclosed out of view by a fence carried nearly from end to end of the engine. Of the weight, which is equally divided on the axles, two-thirds is available for adhesion. There are 158 boiler tubes, 1¼ in. diameter, with ·50 in. clearance, the boiler barrel being 3 ft. 8 in. diameter.

A neat, compact, and serviceable little tank engine was exhibited and manufactured by Messrs. Manning, Wardle, and Co., specially adapted and extensively used for collieries, ironworks, and public works. This engine was employed at he Exhibition under the author's superintendence in conveying the machinery on trucks from the unloading cranes to its destination in the western annexe along lines of rails laid down for the purpose; a duty in which it was of essential service. It has 9 in. outside cylinders, and four wheels coupled of 2 ft. 9 in. diameter, on a wheel base of 4 ft. 9 in. The area of fire-grate is nearly 5 square feet; and the boiler has 55 tubes, 2 in. diameter, with ·69 in. clearance, which is amply sufficient for circulation. The weight in working trim is 10¼ tons, equally distributed over the two pairs of wheels. The water tank is placed upon the barrel of the boiler, and holds 252 gallons. The coke boxes hold 7¼ cwts. Giffard's injector is employed. With a working pressure of 120 lbs. per square inch in the boiler, the exhibitors assume an effective mean pressure of 60 lbs. in the cylinders, which appears too low, but errs on the safe side; upon this they estimate the extreme tractive power as equal to moving 206 tons, but the actual power of the engine is no doubt greater.

The last and the smallest locomotive exhibited in the English Section is a tank engine for ironworks and collieries in South Wales, manufactured by the Neath Abbey Iron Co., for a gauge of 2 ft. 8 in., with 8 in. cylinders and four coupled cast-iron wheels of 2 ft. 4 in. diameter, 4 ft. apart centre to centre. The centre of the boiler is only 2 ft. above the rails. The boiler has 3¼ square feet of grate, and 59 tubes, 1¼ in. diameter and 6 ft. long, giving a total heating surface of 181 square feet; the gross weight in working order is 6·85 tons. The tank is on the back of the boiler. The engine is carried on volute springs. The engines employed in the Neath Abbey Works have a run of nearly one mile, with gradients varying chiefly from 1 in 15 to 1 in 26, with a small portion 1 in 100; they take the return empty waggons up the incline to the coal pits, the full ones going down by themselves. With 80 lbs. pressure of steam the regular duty of the engine is to take up 16 empty waggons or trams, weighing altogether 6·45 tons, or nearly the weight of the engine itself, in 7 minutes, or at the rate of 8 miles an hour. With 66 lbs. steam it can take up at the same speed 12 waggons weighing 4·50 tons.

(To be continued.)

IMPROVEMENT IN THE MANUFACTURE OF WIRE-ROPE.

It is well known to our nautical readers that there are two descriptions of wire-rope in use for ships' rigging, the best being called charcoal, and the second B B, the relative sizes and strength being usually compared as 3 in. charcoal, 7¼lb. per fathom, to 3¼ in. B B, 10lb. per fathom. The *Liverpool Daily Post* states that an important improvement has been made in the manufacture of the latter quality of rope, bringing it to the standard of charcoal rope, and at considerably less price. Six samples of this new manufacture, cut from a large parcel of rope shipped for a foreign Government, were recently tested at the Public Testing Works, Birkenhead, with the following result, as certified by Mr. Macdonald, superintendent. Breaking strain of six samples of the new manufacture of wire, "merchant navy brand," Garnock, Bibby, and Co., manufacturers:—

	Tons	cwt.
6 in. merchant navy with hempen cores ...	39	4
Card test for B B rope	36	0
3 in. merchant navy with hempen cores ...	12	17
Card test for B B rope	8	11
2 15-16 in. merchant navy with hempen cores	11	0
Card test for B B rope	8	8
2¼ in. merchant navy with hempen cores ...	6	14
Card test for B B rope	5	6
1¾ in. merchant navy with hempen cores ...	3	12
Card test for B B rope	3	5
1½ in. merchant navy with hempen cores ...	3	4
Card test for B B rope	2	5

The above result is considerably above the Admiralty test for charcoal rope: for instance, the Admiralty test for 3 in. charcoal rope is 11 tons 14 cwt.; 2¼ cwt. charcoal is 6 tons 7 cwt. In conclusion, considering that the merchant navy rope is considerably cheaper than charcoal, we have no doubt it will come into general use for rigging purposes.

TO CORRESPONDENTS.

Notice.—The NEXT NUMBER of the MECHANICS' MAGAZINE will be PUBLISHED ON THURSDAY, the 24th inst., at Two o'Clock; and Advertisements for that Number must be received at the Office Before Six o'Clock on Wednesday evening.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

D. B. F.—The diameter of the] supply pipe for a single cylinder water-pressure engine, may be found by multiplying the diameter of the cylinder by ·41.

Iron (Dunfermline).—The first part of your letter is so confused that we are at a loss to understand its meaning. The yield of a puddling funace averages about 18 tons per week.

C. F. (Liverpool).—Place your crank handle 3 ft. from the platform, and make it 15 in. to 17 in. radius.

S. B.—No. 357, 1862.

Correspondence.

NARROW GAUGE ENGINES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE".

Sir,—Having read the various remarks published in your Magazine upon the above subject, we feel in some measure called upon to offer a few words in explanation; more particularly so, after reading the letter of Messrs. Manning and Wardle, published in your journal of last week, wherein it might be inferred by any one reading it, that we had made the engines for the Festiniog Railway Company from a design supplied by them, although we are fully satisfied by a letter received direct from themselves, that *they* are *now* quite convinced that we did not even see their plans.

The statement they make in their published letter, with reference to the plans, we believe to be strictly correct, and were quite sufficient to induce them to believe, "as they state in their letter to us," that Mr. Holland had copied the drawings sent to Mr. Spooner, and handed them to us for execution; but, to do Mr. H. justice, he was not guilty of anything of the sort. That gentleman brought to us, in the month of September, 1862, an original sketch of a locomotive engine, asking us if we were disposed to make some such engine for the Festiniog Railway Company, capable of taking a load of 25 tons up an incline of 1 in 70, at the rate of 6 miles per hour, upon a gauge of 2 ft. only. In this we saw no difficulty, and at once said, we could do so; but, that if we made the engines at all, it would be from our own drawings, to which he at once assented, as he did not seem to attach any degree of importance to the sketch he brought with him, as he wished to leave the design and execution of the engines entirely in our hands, so that the company might hold us responsible for the same. All they desired was, to get an engine, capable of performing the amount of work required, upon their line of 2 ft. gauge; and he took his drawing away again, which we have never seen since, but is probably the same drawing submitted to Messrs. Manning and Wardle, on the 28th of October following, as stated in their letter.

After some correspondence between ourselves and Mr. Spooner, the company's engineer, we sent him an outline of the engine we purposed making, without any details, engaging that the engine when made should do the work required; and it is very satisfactory to all parties, that the engines now at work are capable of taking up the incline double the load, and at double the speed that was contracted for.

We may state that we never saw any difficulty, o any considerable degree of merit, in designing these engines, when first applied to; but, when we heard the various opinions of several engineers of eminence, quoted in Parliament, as to the impracticability, we began to inquire of ourselves whether we were really correct in our calculations, and made a thorough revision of the subject, when we became more than ever convinced of its practicability. The fact is, they are simply a reduction of the light locomotive engine we exhibited in the Great Exhibition of 1862, which engine was barred from receiving a

prize medal, "as Colonel Yolland, the foreman of the Jury of Class 5, in which locomotives were exhibited, told our Mr. England," that, on account of our having received the prize medal of the Exhibition of 1851 for a similar engine, the jury could not award us another medal for the engine, which was practically the same—thus showing that we have been in the habit of making this sort of engines for many years, which were well known as "The Little England" class of engine, we having made them several years previously to 1851.

In order to be perfectly safe with reference to the centre of gravity upon so narrow a gauge, we pitched that, in our design for the Festiniog engines, precisely the same as the centre of gravity was found in a number of engines we had then just completed for the Great Western Railway Company, which are daily running at the rate of fifty miles per hour; we therefore felt that the small engines would be equally safe upon their narrow gauge, as the result has proved; hence, it will be seen that the subject was nothing new to us, as we considered it only as a matter of ordinary business; and if any such eminently practical engineers as the late Mr. Robert Stephenson stated, that to make such engines for the 2 ft. gauge was impracticable, we feel it must have been under some misconception of the case submitted to them.

We may also state what we know of the circumstance that gave rise to the report, which appeared in many of the papers, giving Mr. Holland the credit of the design of the Festiniog engines. The facts are, that the day of opening the Festiniog line with locomotive engines was made a grand gala day, and a large party went up the line, from Port Madoc into the mountains of the Festiniog Slate Quarries, "the source of their traffic," a distance of 14 miles, with flags flying, bands playing, and other demonstrations of rejoicing; on which occasion, two engines were employed—the first driven by our Mr. England, and the other by one of our staff who had been sent down to put the engines to work on the line—the first engine having a train of 20 waggons, and the second engine 24 waggons, all fitted up with seats and crowded with people; they thus travelled as two separate trains at a distance of about 500 yards apart at a speed of 12 miles an hour.

Having enjoyed very much the trip up the mountains, the whole party, consisting of many of the quarry proprietors and the principal gentlemen of the neighbourhood, amongst whom were Mr. C. M. Holland and many of his friends, "who are extensive quarry proprietors," returned to Port Madoc, and sat down to a sumptuous dinner, in the Townhall, where, in an after-dinner speech, proposing the health of Mr. C. M. Holland, the remarks were made, attributing to him the design of the engines they had seen that day working so efficiently; but to do Mr. H. justice, he immediately spoke to Mr. England, repudiating such remarks, who said, "Never mind, let it pass; you are known here; and it will do you no harm." Hence, nothing was said publicly in contradiction, and the whole affair being extensively reported to the local journals, gave circulation to these erroneous reports, and very naturally called forth the letter from Messrs. Manning and Wardle.* Trusting that these few remarks will explain the subject clearly to yourself and the public,

We remain, Sir, yours very faithfully,
G. ENGLAND AND CO.

Hatcham Iron Works, London,
December 16th, 1863.

Miscellanea.

A smart shock of an earthquake was experienced on the night of Wednesday week, at Nimes, Avignon, Montpellier, and other towns in the South of France.

The new contract between the Government and the Montreal Ocean Steamship Company has just been signed by the Postmaster-General, subject to the approval of Parliament. The contract is for five years. The amount payable by Government is £54,500 currency (218,000 dols.) per annum. The contract provides that the vessels shall slacken speed or stop whenever danger is feared from fog or icebergs; and time thus lost is not to be regarded as a default on the part of the contractors. It has also been very properly made a condition of the contract that the steamers shall not approach Cape Race in bad weather.—*Toronto Globe.*

* It is only just to Mr. Holland to state that he never, "to our knowledge," in any way attempted to appropriate the remarks in his favour, but always said that it was perfectly ridiculous, as he had nothing whatever to do with the matter.

Belgium possesses an order of merit for industrial and agricultural labourers. The decoration worn by the members has just been modified by royal decree, and now consists of a medal bearing an emblematical figure representing manufactures or agriculture, as the case may be, upon a black enamel ground, surrounded with a red border. The design is enclosed within a fillet, on which are inscribed the words "Skill; morality." Around the whole is a wreath of laurel in blue enamel for artisans, and green for agriculturists, surmounted by the arms of the country, suspended to a royal crown. The decoration is suspended to a ribbon of the national colours, which, however, cannot be worn without a medal.

There were a further series of experiments on Friday in connection with floating targets. At a thousand yards the 600-pounder Armstrong sent a steel shell through the "Warrior" target (which had been moored out at sea for the purpose of being fired at); but the 300-pounder unfortunately missed it four times—the third shell bursting in the gun—and hence there was no opportunity afforded of comparing the relative effect of these pieces. It may, however, be added that the effect of the shell's bursting was terrific, and shook the target nearly to pieces. The initial velocity of the 600-pounder projectiles was 1,150 ft. per second.

The Emperor of Russia has commanded a large supply of heavy steel shot and shell to be forthwith forwarded to the Imperial arsenals. The manufacture of these missiles is partly to be carried on in Russia and partly in England, Messrs. John Brown and Co., of the Atlas Works, Sheffield, have already received directions to prepare with all despatch for shipment 5,000 large shot, carefully prepared under the Bessemer process.

The estimates of the probable supplies of cotton for the year 1864 have been published, and the several opinions, with the names of the several authorities, merit insertion together:—

Mr. Cheetham	2,445,000 bales.
Messrs. Neill	2,665,000 „
Mr. Ashworth	2,825,000 „
Mr. Whitworth	2,915,000 „

The total imports of the year now drawing to a close will have amounted, as has been conjectured from the returns already published by the Board of Trade, to about 1,910,000 bales. Thus the least sanguine among those qualified apparently to forecast the future counts that next year we shall receive one quarter as much again as we have received this year, while the most sanguine among them puts the augmentation at half as much again.

On the 1st prox. an Act passed in the late Session for the more effectual condensation of muriatic acid gas in alkali works will take effect. The term "alkali" is to mean every work for the manufacture of alkali, sulphate of soda, or sulphate of potash in which muriatic gas is evolved. The object of the statute is to secure the condensation of the gas to the satisfaction of the inspector or sub-inspector appointed under the Act. If it should appear to the Court before whom any proceeding for the recovery of a penalty is instituted that 95 per cent. at least of the muriatic acid gas evolved has not been condensed, a penalty not exceeding £50 will be levied, and for a second offence £100. The owner is to be liable for the offence in the first instance, unless he prove that the offence was committed by some agent, and without his knowledge, in which case the agent, &c., is to be liable. The Board of Trade is to appoint inspectors, and alkali works are to be registered.

A short time ago the divers engaged searching the pool where the "Royal Charter" broke up four years ago came upon a very rich store of gold. They found in the same spot, in the course of a few days, about £1,200 in sovereigns and a bar of pure gold, weighing 9½ lb., which was brought up to London this week. The treasure was far from being exhausted, when the storm came on and put a stop to the diving operations for the season. Messrs. Gibbs, Bright, and Co., the owners of the vessel, sold about a year ago, to some persons in Anglesea, all claim to the treasure found on the spot, and it is said that the speculation has already paid 300 or 400 per cent. profit, although the cost of working it is very considerable.

A pyramid has recently been discovered in California resembling the pyramids of Egypt in every detail of its construction, but very much smaller. The stones of which it is composed are about 6 ft. long, and vary in thickness from 1 ft. to 3 ft.

A lecture on "The Science and Practice of Electro-Metallurgy" was delivered on Wednesday last, by Mr. A. B. Midlane, at the Whittington Club. The subject was well illustrated by fine examples of the art, lent by Messrs. Elkington and Co., R. W. Kennard and Co., and the General Foundry Company. The examples of the last-named firm were of subjects of particular interest to the building trades, being bassi-relievi designed for the ornamentation of stove grates and chimney-pieces. The next lecture is announced for the 13th proximo, on "The Metal Work of the late Exhibition," and is to be delivered by the Rev. Charles Boutell, M.A.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—*none.*
BUILDINGS AND BUILDING MATERIALS, 1177, 1189, 1207, 1214, 1219.
CHEMISTRY AND PHOTOGRAPHY, 1156.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 1176, 1185, 1188, 1190.
ELECTRICAL APPARATUS, 1199, 1200,
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1158, 1166, 1167, 1179, 1192, 1194, 1197, 1208, 1210.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1201, 1205, 1209.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1165, 1168, 1169, 1170, 1182, 1184, 1195, 1196, 1198, 1204, 1211, 1212.
GENERAL MACHINERY, 1161, 1162, 1163, 1164, 1178, 1193, 1206, 1216, 1218.
LIGHTING, HEATING, AND VENTILATING, 1213, 1215.
METALS, including apparatus for their manufacture, 1181.
MISCELLANEOUS, 1157, 1173, 1202, 1217.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 1172, 1180, 1183, 1191:
SHIPS AND BOATS, including their fittings 1171, 1186, 1203.
STEAM ENGINES, &c., 1159, 1160, 1174, 1175, 1220.
WARFARE, 1187.

1156. W. CLARK. *Improvements in coating wrought or other iron to protect it from corrosion or oxidation.* (A communication.) Dated May 8, 1863.

The patentee claims—1, obtaining upon the surface of iron a coating composed in part of metallic aluminium, by covering it with a compound of porcelain frit, white lead, felspar and fat, alum or potash clay, and subjecting it to a single baking operation, as described. 2, obtaining upon the surface of iron a coating of metallic aluminum, either by covering it with a paste of fat, alum or potash clay, and boracic acid, and subjecting it to a baking operation, or by fusing the said paste and dipping the iron, heated to a red heat, in the molten fluid, and after it is cold applying the coal or kerosene oil, as described. *Patent completed.*

1157. E. O. BORT. *Improvements in tanning hides and skins.* (A communication.) Dated May 8, 1863.

By the use of this invention any hides or skins can be tanned, although they have not been previously deprived of their hair or wool, which will be preserved; they are also rendered tough, supple, and waterproof. Skins thus prepared are fit for coverings for the feet, carpetings, knapsacks, and other similar objects. The skins are thoroughly penetrated by the tannin, and in a shorter time than by the usual process. The substances which the patentee makes use of are the following:—Tan or oak bark, cashoo or catechu, sumach—a plant known in commerce as "divi divi" fennel, and common salt. *Patent completed.*

1158. C. F. BIELEFELD. *Improvements in the manufacture of sheets, slabs, and other articles where fibrous materials are employed.* Dated May 8, 1863.

In carrying out this invention, the patentee takes woven or other suitable fabric, such as fabrics of woven cocoa-nut and other fibres, felt paper, dry hair-felt, and such like, and he thoroughly saturates the same with a compound of water glass (soluble silica), clay, and lime, with or without metallic oxides: the proportions he prefers are as follows:—Clay, 1 lb.; lime, 1 lb.; pumice stone, 1 lb.; pulp, 6 lbs.; water-glass, 8 lbs. He also makes a plastic material composed of the same, adding a quantity of paper pulp, or other like material, in about the following proportions:—2 lbs. of a mixture composed of equal parts of clay, lime, and pumice stone; 8 lbs. of water glass; and 2 lbs. of pulp, which is trowelled over the prepared pieces of fabric, filling up all the interstices of the fabric. Where greater thickness is required, he places two or more thicknesses together, and gauges or trowels the surfaces to the thickness or purpose required. He also makes thick boards by the like mixtures with paper pulp in a very fluid state. The mixture must be kept in motion in order that it may become thoroughly incorporated. It is then poured into frames according to the thickness required. To the bottom of the frame he fixes either gauze wire or perforated metal. *Patent completed.*

1159. G. T. BOUSFIELD. *Improvements in steam engines.* (A communication.) Dated May 8, 1863.

The patentee claims—1, inc[illegible] average diff. between the temperature [illegible] cond. cooler and the temperat[illegible] water

combination of a cooler, or of a surface condenser, with a double eduction, in the manner described; 2, condensing the steam discharged from the cylinder of a steam engine by the first eduction, by delivering the steam into the hot well of the engine, as described; 3, taking the steam from the cylinder by the first eduction on the induction side of the piston through openings made midway in the length of the cylinder, without the intervention of a valve moved by the mechanism of the engine, as described; 4, delivering the steam discharged by the first eduction from the cylinder of a locomotive engine into the feed-pipe between the tank and the force pump, as described. *Patent completed.*

1160. W. THOMPSON. *Improvements in obtaining motive power, which improvements are applicable in part for raising or forcing fluids into steam boilers, tanks, and other vessels.* Dated May 9, 1863.

This invention has for its object improvements—1, in obtaining motive power; 2, in raising fluids; and 3, in raising and forcing fluids into boiler tanks and other vessels. The invention consists of an apparatus, the principal parts of which are a rotary double wheel or wheels, which turn together, one being impelled by the other, formed as hereinafter described, and fitted and caused to rotate in suitably formed enclosed cases, through which steam or other elastic vapour or fluid passes. The first of these wheels the patentee denominates the motive wheel or motor, and the second the impelling wheel or impeller. The motor is operated upon by the force or momentum of the steam, vapour, or fluid, and the impeller operates upon the fluid to be raised or forced. When the apparatus is used for driving machinery, a drum, pulley, or crank takes the place of the second wheel or impeller, and a simple supply and discharge pipe only is required to be fitted to the motor case. When the apparatus is required to raise liquids—as, for instance, water from a well or mine of considerable depth—the discharge pipe is fitted with a number of branches opening into the rising main; and, when required to raise and force liquids into a boiler or other vessel against pressure, the discharging pipes are joined into one, and fitted with the valves and sliding cone or cones described. *Patent completed.*

1161. J. STRICKLAND. *Improvements in laying veneers on to surfaces, in applying the glue for that purpose, and in apparatus employed.* Dated May 9, 1863.

The patentee claims—1, laying veneers on to surfaces by so applying the requisite pressure by means of rollers or their equivalents that it is exerted upon only a small portion of the surfaces to be united at one time, the whole of the surfaces being subjected in a progressive manner to such pressure; 2, constructing apparatus for laying veneers on to surfaces in which the veneers and surfaces are caused to pass between rollers or their equivalents that are made to exert the requisite pressure upon them as they pass through, substantially as described; 3, applying the glue to surfaces to which veneers are to be applied by means of revolving brushes, as set forth. *Patent completed.*

1162. S. WILSON. *Improvements in hoops or bands for fastening bales, and in machinery or apparatus for making the same.* Dated May 9, 1863.

In performing this invention, the inventor makes the ends of the bands with V or other shaped recesses and projections which fit into each other. The ends of the bands when brought together are securely held by a clip, which is slipped over them. The clips are made of malleable cast iron, or of sheet iron or wire bent over a mandril. In unfastening a bale secured by the above-described improved hoops or bands, it is only necessary to slide the clip beyond the recesses and projections, when the bands are set at liberty, and may be used over again. *Patent abandoned.*

1164. J. NORIE. *Improvements in making moulds for casting, and in apparatus therefor.* Dated May 9, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1165. J. PAGE and A. T. WAYNE. *An improvement or improvements in the manufacture of pens.* Dated May 9, 1863.

This invention consists in making pens from aluminium alloyed with copper, or what is generally termed aluminium bronze. *Patent abandoned.*

1166. J. BRIERLEY. *Improvements in dyeing knickerbocker yarns and textile fabrics manufactured of or from such yarns.* Dated May 9, 1863.

This invention consists in having the fibres, or such of them as are intended to be dyed bright colours, mixed, spun, and scoured, or washed before drying them. The dyeing is then effected either upon the yarns before weaving, or upon the fabrics made of such yarns by any of the known methods of dyeing mixed fibrous substances. *Patent abandoned.*

1167. W. BOALER. *An improved dryer fabric for paper making.* Dated May 9, 1863.

This invention consists in the use of a peculiar cloth, which is composed of many webs and threads all bound together in the weaving, and forming one cloth, either twilled, plain, or chain. By preference, he employs cotton, but linen, wool, or any textile or fibrous material could be used either wholly or in combination with cotton. *Patent completed.*

1168. E. R. CLARK. *An improvement in the construction of portable wine cases or bins for domestic use or export and a picnic chest combined.* Dated May 9, 1863.

In carrying out this invention the patentee employs an ordinary deal or other wood box or case, and provides two partitions from top to bottom, fixed at about an inch from each end or side, as the case may be, each of such partitions having as many circular holes cut in them as may be required, and each of a little longer diameter than the usual size of wine bottles. The centres of the ends or sides of the said box or case are either grooved of a dovetail shape, or plain, square, or provided with slips to form a groove fixed at about half an inch apart to receive sundry pieces of wood, one of which is fixed at the bottom of the said box or case; the first tier of bottles being placed in the case, a piece of wood is inserted down the groove, and so on until the case is filled, when it is so arranged that one piece comes level with the top edge of the case, and consequently, when the lid is closed the bottles are securely fixed. *Patent completed.*

1169. N. LEGENDRE. *Improvements in the construction of scissors.* Dated May 9, 1863.

This invention consists in the construction of scissors in such manner as to cut two pieces or threads at one and the same time, the scissors being worked in the ordinary manner as hereafter described. Two arms or blades terminating at one end in rings are jointed together at the other end and about which point they are free to move. Two other arms shorter than the first are jointed at their rear end, and are united by screws or rivets to the first-mentioned blades, and which cut on their outside edges whilst the others cut on their inside edges. If now, for example, the scissors are opened, and the foremost or those points which are jointed together are introduced into a loop of tulle, and the instrument is pushed forward until the loop is stretched; on closing the scissors the two ends of the loop are cut at one and the same time, and by the same motion. Scissors made in this manner may be fitted to a cross bar, and arranged so as to suit certain designs, and thus engage one series of loops in the scissors which follow, all being worked by a single motion. *Patent abandoned.*

1170. R. A. BROOMAN. *Improvements in the manufacture of lampblack.* (A communication.) Dated May 9, 1863.

This invention consists in manufacturing lampblack by the pulverization of charcoal in manner hereafter stated. The inventor takes cylindrical vessels one or more, and mounts them upon trunnions, so that they may be rotated at any speed required; an aperture in the side serves for the admission of the charcoal to be pulverised, and also for the insertion of a number of balls or spheres of iron, glass, stone, marble, or other like suitable material. The aperture is then covered with wire gauze or perforated plate, which only affords passage to the charcoal when in a state of fine powder. The cylinders are caused to rotate, and the charcoal becomes reduced to impalpable powder or lampblack under the action of the balls. *Patent abandoned.*

1171. J. B. WOOD. *Improvements applicable to the defending of ships or vessels and forts when armour plating is employed.* Dated May 9, 1863.

The object of this invention is to apply in combination with, and as a backing to, armour plating, thick sheets, blocks, or masses of the hides of buffaloes or other animals, which are first disintegrated or ground into a plastic condition, and then formed into sheets, blocks, or masses suitable for being interposed as a backing between the armour plating, and the body of a ship, vessel, or fort. *Patent abandoned.*

1172. J. BURRELL. *Improvements in machinery for cutting the teeth of bevelled wheels.* Dated May 9, 1863.

For the purpose of cutting the teeth of bevel wheels, the patentee mounts the wheel to be cut on an axis, which is held stationary whilst the teeth are cut, except that in passing from one tooth to the next it is turned through a portion of a circle, corresponding with the number of teeth to be cut. In connection with the axis there is a division plate, by means of which the angular motion required to be given to the wheel in passing from tooth to tooth is accurately measured. The teeth of the wheel are cut by means of a planing or shaping tool held in a carrier or tool box, which is made to slide to and fro on a guide frame, as in a shaping machine; but the guide frame, in place of being made stationary, is made capable of being moved at one end in such manner as to allow it at the other end to move both up and down and sideways, so that the tool, as it travels to and fro on the guide frame, may give the required contour to the side of the tooth which is being cut. The point of the guide frame is also so arranged that the tool constantly moves radially to and from a fixed centre point, whatever be the position of the guide frame, and the bevelled wheel to be cut is so placed, that the apex of the cone of which it is a frustrum coincides with the said centre point, to and from which the cutter is caused to move. The apparatus is also so arranged that the cutter can, when required, cut up to the centre point about which the one end of the guide frame turns. With these ends in view, the following construction or combination is adopted:—The guide frame is formed with trunnions at its end, which are mounted in bearings on a semicircular slide, which is capable of sliding in a semicircular groove struck from the centre point, to and from which the cutter is constantly moved. The vertical motion of the guide frame is on its trunnions, and its lateral motion is by the semicircular slide moving in its guides or groove. The vertical motion, which is slow and uniform during the cut, is given by a train of wheels, the last of which gears with a toothed arc fixed to the guide frame, and the lateral motion of the guide frame is given by a pattern surface of a form suitable to produce the contour of tooth desired. The carriage of the axle on which the wheel to be cut is placed, is arranged to slide on a bar, and to be fixed thereon in any desired position. The bar on which the carriage slides is arranged to be raised and lowered and retained in any required position, and the axis on which the wheel to be cut is placed, is arranged to be set and adjusted on its carriage to the angle required for any particular bevel wheel. *Patent completed.*

1173. C. H. G. WILLIAMS. *Improvements in the manufacture of colouring matters.* Dated May 9, 1863.

In carrying out this invention, the patentee prepares a blue colour, suitable for dyeing and printing, and mixes one part by weight of rosaniline, or one of its salts—such as the acetate, hydrochlorate, or sulphate—with eight parts of oleate of aniline, or with four parts of oleic acid, and four parts of aniline. He then heats the mixture to a temperature between 300 deg. and 400 deg. Fahr., until the whole is converted into a deep blue mass, soluble in spirit of wine. Any oleic acid and aniline remaining in the mixture may be removed by first boiling with dilute sulphuric acid, and then with coal naphtha or photogen. The impurities are thus removed and the colouring matter remains behind in the form of a coppery or bronze-like mass. For the purpose of dyeing, it is merely necessary to dissolve this bronze-like matter in spirit of wine and add it to the bath. The word aniline, in this specification, is intended also to include toluidine and other substances very closely resembling aniline and which are known as the homologues thereof. *Patent completed.*

1174. J. BURRELL. *Improvements in salinometers.* Dated May 9, 1863.

For the steam boilers of sea-going steam ships, in order to determine from time to time the amount of salt contained in solution in the water in the boiler, the patentee leads two pipes, the one from the top and the other from the bottom of the boiler. These pipes he connects with a glass tube, so that the said tube forms a connection between the two pipes. The arrangement is thus very similar to the ordinary water gauge of a steam boiler, but differs from it in the employment of a considerable length of pipe above and below the glass tube. In the upper pipe into which the steam from the boiler enters condensation is constantly going on, and the water thus distilled runs down and fills the lower pipe. The water stands in the glass tube as in an ordinary gauge tube, but its level will not be the same as that in the boiler, for the weight of the salt water in the boiler will raise the column of distilled water in and above the glass tube to a height considerably above its own level. An ordinary gauge tube gives the water level of the boiler; and this, when compared with that of the salinometer gauge tube, will indicate on a scale attached, or by reference to a table the density of the water in the boiler. *Patent completed.*

1175. J. H. JOHNSON. *Improvements in rotary engines.* (A communication.) Dated May 9, 1863.

This invention relates to a peculiar construction and arrangement of rotary engine, and consists in the employment of two pistons, each filling about one quarter of the annular steam space surrounding the main shaft inside the cylinder. These pistons work loose upon the main shaft, but are each connected by a long collar or boss with a disc outside the cylinder, on the periphery of which are formed two ratchet teeth or notches on diametrically opposite sides of the disc, which take into a fixed detent or stop, the object of this detent being to prevent the rotation of the disc, and its corresponding piston in other than one direction. The steam is admitted into the cylinder between the contiguous faces of the two pistons (which are always at the completion of each stroke nearly close together) by means of two distinct ports or passages made longitudinally in the shaft, each communicating with a transverse passage passing diametrically through the shaft from side to side. At the steam inlet extremity of the main shaft there is a disc which answers as an expansion valve, being provided with an opening which exposes only one of the two longitudinal passages at a time, but as the shaft rotates it follows that each passage is open alternately. In front of this disc there is a steam chest, into which the steam is conducted by a steam pipe from the boiler. Close to each of the notched discs hereinbefore referred to there is keyed on to the main shaft another notched disc, and into the latter engages a pawl, carried by each of the notched discs first referred to, which are connected direct to the loose pistons. The steam enters the cylinder between the faces of the two pistons, and tends to separate them in opposite directions; but as one of them is prevented from rotating in a backward direction, by the detent or stop above referred to, the other alone is free to rotate, and describes a half revolution. During its semi-revolution it carries round with it through the discs and connecting pawl the main shaft, whereupon the second steam passage is opened, and steam again enters, but by the second transverse port between the contiguous faces of the pistons, and forces round the piston which was previously held stationary, whilst that which has last operated is held in turn by its detent and prevented from rotating backward. The shaft is thus carried round continuously by a series of half-revolutions of the two pistons acting alternately upon it in one and the same direction. *Patent abandoned.*

1176. J. LEE and M. GUTTERIDGE. *Improvements in agricultural implements.* Dated May 9, 1863.

This invention relates to ploughs, harrows, haymaking machines, horse rakes, hand rakes, and subsoil looseners, and consists in constructing such implements as follows—1, as regards ploughs, this invention consists in forming the handles and beams thereof of wrought-iron gas-tubing or piping, such as is at present used by gas fitters, the object being to lessen the weight of ploughs without lessening the strength and durability thereof; 2, as regards harrows, this invention consists in forming the same of gas tubing, and in adapting to harrows an oscillating motion, derived either from two cranks, or from two eccentrics working on a shaft supported by two wheels in front, the joints being so constructed as to allow of the oscillation of all the harrows. As regards haymaking machines, this invention consists of a new and improved method for throwing out the socket pinions simultaneously from one side of the machine, and putting them into either forward or backward motion as required, without resorting to a hollow tube or main axle for fastening on and carrying the heads which contain the requisite gearing for working the time barrel, thus avoiding weakness and liability to break across at the angles of the long slot, hole, or groove, in which the reversing forks slide forward or backward. *Patent abandoned.*

1177. B. HARGREAVES. *Improvements in tiles for drainage or sanatory purposes.* Dated May 11, 1863.

This invention consists in making earthenware tiles, or tiles of other material, of a conical or taper shape, or otherwise of a conical or taper ended shape (whether plain or fluted on the surface, or depressed at the ends), so that the smaller end of one tile fits into the larger end of another or next adjoining tile, thus preventing the ends becoming disconnected from each other by the settlement of the ground on which they rest, such sides also not admitting dirt or other obstructions getting in at the junctions, and impeding the flow of water or other liquids through

them. The said tiles also admit of being laid in curved courses in the ground or having branches affixed to the sides of them on the conical or taper principle of joints as aforesaid for cross drains, the whole being thereby coupled together, and forming a permanent and endnring system of drainage. *Patent completed.*

1178. R. BURGESS. *Improvements in machinery or apparatus for marking, etching, engraving cylindrical and other surfaces.* Dated May 11, 1863.

This invention relates to those descriptions of marking, etching, or engraving machines in which the pentagraph is employed for giving the required movements to the roller or surface to be operated upon, and consists of certain improved arrangements for supporting the ordinary floating table which carries the roller or surface, in order that the table may be moved longitudinally and transversely with ease and certainty. The plate or surface of the table rests near each end upon two discs or wheels supported on a triangular shaft, placed transversely across the machine, and having bearings so that it can revolve. The two shafts are parallel with each other, and their surfaces form beds on which run pulleys or guide rollers carrying as many bars as there are surfaces, which bars are connected to a box or frame fixed to each disc or wheel. *Patent completed.*

1179. C. and W. SHORROCK. *Certain improvements in power looms for weaving.* Dated May 11, 1863.

This invention consists—1, in the novel and peculiar arrangement of apparatus for applying or regulating the power or friction of the brake on the warp beam, whereby the patentees are enabled to keep a constant pressure upon such beam during the operation of weaving; but should there be any imperfection in the weaving, necessitating a reverse motion of the said warp beam, such reversing is accomplished without any pressure upon the beam by the said brake. The improved arrangement of mechanism may be described as follows:—Upon one end of the warp beam is fixed a cylindrical bush supplied with a ratchet wheel, such wheel being acted on by a pawl or catch secured to a grooved ring or hoop encircling the before-mentioned bush, a strap of leather or other suitable material being fitted into the groove of the ring, the pressure being exerted upon it by means of a clip or brake; it is so arranged that when such clip is tightened, it shall exert a pressure upon the warp beam through the medium of the before-mentioned pawl and ratchet wheel during the operation of weaving; but should any reverse or backward motion be given to the warp beam, the pawl or catch slips over the teeth of the ratchet, thereby allowing the bush encircling the warp beam to revolve freely within the grooved ring without any pressure, the only pressure upon the warp beam being effected by the contact or resistance of the pawl or catch against the ratchet wheel. Upon the adjustable pressure clip is a small bowl acted upon by a spring in such a manner that it shall always cause an even tension to be given to the warp. A second part of these improvements consists in the employment and use of bowls or pulleys secured below the healds, and above the treadles to which the healds and treadles are attached, by means of straps; such straps, when the treadles are in motion, partially wrap or fold upon the before-mentioned pulleys, causing by their connection with the healds a constant rise and fall or shedding to such healds. These bowls or pulleys act as intermediate carriers between the treadles and the healds, lessening the strain or weight upon the healds, thereby causing such healds to be more durable and lasting, also easier in their action upon the warps. *Patent completed.*

1180. C. L. V. TEXAC. *A new wrought-iron railway sleeper.* (A communication.) Dated May 11, 1863.

This invention is not descrbed apart from the drawings. *Patent completed.*

1181. C. L. V. TEXAC. *Armour plates of hammered or rolled wrought iron, the whole of the rivets being protected against the direct blows from the cannon shots.* Dated May 11, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

1182. J. PARKINSON. *A new or improved mode of manufacturing tablets to be used for monumental purposes.* Dated May 11, 1863.

This invention consists in forming tablets to be used for monumental and other purposes of earthenware, the inscriptions thereon being raised or sunk by means of moulds. *Patent abandoned.*

1183. R. A. BROOMAN. *Improvements in coupling and disconnecting carriages on railways, and in machine employed therein.* Dated May 11, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1184. J. S. GUIBETTE. *An improved inhaling apparatus.* Dated May 11, 1863.

This apparatus consists of a vessel fitted as hereinafter explained, through which air is to be drawn before being inhaled. This vessel is provided with an inlet tube for the admission of air, and the mouth of this tube is covered by one, two, or more loose cones or thimbles which fit over one another, and in the crown of each of which is an aperature. The aperture in the lowest cone is the largest and in that next above it is smaller, and so on, the aperture being smallest in the top cone. By these apertures the admission of air is graduated according to the requirement of the particular case being treated. There is also an outlet pipe from the vessel, which opens into a tube terminating in a mouthpiece, and of sufficient length to cause the condensation of any condensible vapours before reaching the mouth of the patient. The inventor prefers the employment of loose perforated cones for regulating the admission of the air, but other means of regulating may be adopted. *Patent abandoned.*

1185. J. SHANKS. *Improvements in machinery for cutting or shearing the edges of grass or turf.* Dated May 11, 1863.

Under one modification, this implement consists of a cast iron frame with handles, somewhat similar to the form of a lawn mower. It is fitted with a roller, which is keyed to a shaft that works in two bearings, one at each side of the frame. The front part of the frame has fitted to it two brackets containing bearings for a shaft, on which is placed one or more small rollers which are used for steadying the implement in working. These brackets may either be fixed or made to slide up or down by means of a slot, and fastened to the side of the frame with a bolt and nut to each. On the back roller shaft is keyed a toothed wheel, which gears into a pinion placed on a counter-shaft, and may be either keyed on the shaft or loose, and provided with a clutch to slide on a sunk key on the shaft for the purpose of putting the implement out of or in gear as may be required. On one end of the counter-shaft is fastened a crank or disc, with a fixed or moveable pin or an eccentric. To this movement one end of a connecting rod is attached, having a bush fitting into the crank or disc pin; or the connecting rod may have a strap to work on the eccentric as may be preferred. The other end of this rod is made to communicate with the arm of a pair of shears by means of an ordinary joint. These shears are similar, or somewhat similar, in shape to the ordinary hand shears at present used for cutting the edges of turf. An arrangement of one or more levers or screws is also provided for raising or lowering the shears as may be required, and also for placing them at any angle that may be found necessary when cutting. In working the implement it is simply moved or pushed forward by means of the guiding handles, when motion is communicated by the gearing to the shears, which cut the edges of the turf with precision. *Patent abandoned.*

1186. J. E. M'CONNELL and G. H. BOVILL. *Improvements in chains for cables and other purposes.* Dated May 11, 1863.

In carrying out this invention, the patentees propose to cast separately a number of detached links of the Bessemer iron or steel, or other suitable homogeneous metal, and then to connect these several links by casting intermediate or coupling links in moulds, into which two of the links are previously so placed as to enable the connecting link to be cast within or around them, and thereby producing three connected links. The end link of the series is then adjusted in a mould in company with another loose link, which latter is coupled or connected to the series by casting another connecting link within or around it. In this way the whole of the links of a chain are cast one within another without weakening the chain by welded joints. *Patent completed.*

1187. B. LILLY. *Improvements in the construction of "snap caps" or "nipple protectors" for firearms.* Dated May 12, 1863.

This invention consists in constructing the outer casing of the snap cap with a top or bottom, or with top and bottom sockets or chambers of suitable depths, so that the leather or other pad on which the gun-lock hammer falls can be securely fastened in the one, and a metal washer fitting the square of the gun nipple loosely secured in the other, while facility is also afforded for the introduction of a soft metal washer in conjunction with the pad in the top chamber, so as to interpose between the pad and the mouth of the gun nipple when the snap cap is in use. *Patent completed.*

1188. W. MATTISON and G. BARKER. *Improvements in grass-mowing and reaping machines.* Dated May 12, 1863.

The object of this invention is to simplify mowing and reaping machines, and to have the cutting apparatus and the gearing for giving motion thereto so constructed and arranged as to be self-adjusting to the irregularities of the ground; also to be readily raised or lowered, and put into or out of motion by the attendant. The cutting apparatus is mounted or carried on framing, which is hinged on bearings in the form of bushes fixed to the ordinary framing of the machine, concentric to the axle thereof, and so as to allow freedom of motion. A cog wheel is placed on the axle, capable of sliding into or out of gear with another wheel or a worm fixed on a shaft mounted on the moveable framing, on which is a crank for giving motion to the said cutting apparatus. The apparatus is raised or lowered, and the gearing put into or out of motion, by means of levers or equivalent appliances. *Patent abandoned.*

1189. T. WARREN. *Improvements in glass and other furnaces or kilns.* Dated May 12, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1190. H. WICKENS. *Improvements in reaping and mowing machines.* (A communication.) Dated May 12, 1863.

The cutting apparatus of this machine is constructed and arranged to be worked on either side of the machine, and either in front or rear of the wheels, and the draught rod is arranged so that the line of draught may be taken from its inside shoe, or from its immediate vicinity. By these improvements the folding finger bar is sustained in the folded position while the machine is in motion from one place to another, and the gearing which drives the cutting apparatus is closed in for exclusion of dust and dirt. The inventor has an adjustable track board for disposing or controlling of the cut grass, and a means of turning the finger bar on its longitudinal axis, so as to elevate or depress the points of the guard fingers, which are constructed in a particular form at pleasure, without changing the relations of the bearings to each other at the two ends of the connecting rod. *Patent abandoned.*

1191. J. E. M'CONNELL and G. H. BOVILL. *Improvements in treating worn-out railway tyres.* Dated May 12, 1863.

This invention relates to modes of treating worn-out railway tyres, whereby, in place of breaking up the tyres as scrap iron, worn tyres may be manufactured into new tyres in hoops in a simple and economical manner. In carrying out the first part of this invention, it is proposed to take an old hoop tyre, say for a locomotive driving wheel, for example, and after heating it to the proper temperature to work the hoop through a suitable tyre-rolling machine provided with compressing rolls acting upon the outside of the red-hot hoop, whereby the diameter of the hoop is gradually reduced, and the thickness of the tyre increased in a corresponding ratio. The rolls are made to give the required form to the new tyre. The second part of the invention for manufacturing old hoop tyres consists in heating the old hoop tyre to a suitably high heat, and whilst in that state to place the same in a mould and pour into such mould around the outer face of the hoop molten homogeneous iron, Bessemer iron, or cast steel, to make up the required thickness of metal for the new tyre. *Patent completed.*

1192. W. WHITELEY. *Improvements in looms for weaving.* Dated May 12, 1863.

This invention relates to looms where two or more shuttles are employed, and consists in arranging and applying the mechanism or apparatus in conjunction with a jacquard machine, so that the loom will be self-acting in the production of the various figures or designs required in the fabric. The improvements have reference more particularly to the box motion of the loom, the shuttle boxes being acted upon by the lifting and sinking bars of the jacquard, which bars are made to project through the frame of the jacquard, and act upon hooks and levers connected directly to the shuttle boxes. By this mode of arranging the mechanism of boxes, they are raised or lowered as required by the jacquard itself, in place of the jacquard being made to govern a special mechanism for lifting the boxes. It is further proposed to adapt a reversing motion to the cylinder of the jacquard, whereby the shuttles are made to return to their former position without disconnecting the boxes and jacquard, and, consequently, their relative positions to each other are always maintained. *Patent completed.*

1193. G. A. HUDDART. *Improved apparatus for cutting slate.* Dated May 12, 1863.

This invention relates to cutting or dividing thick slabs or blocks of slate. The improved apparatus consists of a machine in which a cutting or planing tool of peculiar form or construction is made to pass over the slab and cut a deep groove therein. *Patent abandoned.*

1194. H. L. EMERY. *Improvements in apparatus for manufacturing saws suitable for ginning cotton and for other uses.* (A communication.) Dated May 12, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1195. R. A. BROOMAN. *Improvements in spring mattresses.* (A communication.) Dated May 12, 1863.

The chief object of this invention is to construct spring mattresses which can be taken to pieces when required and packed into a small space for removal or otherwise. The frame of the mattress may be made of wood or iron. The construction, when the frame is of wood, is as follows:—Two boards or planks forming the sides of the mattress carry brackets for receiving two other boards or planks for the ends; transverse bars strengthen the sides and carry spiral or other springs. The ends are connected to the sides by bolts and nuts, which bolts pass through the brackets. Transverse planks are fixed on the ends, pegs are fixed on these planks, to which laths or flat chains passing from end to end of the mattress are hooked; these chains pass over and are sustained by the springs which are supported by the first-mentioned transverse bars, and are strengthened by other transverse laths. To take to pieces a mattress constructed as before described, it is only necessary to unhook the laths and to unscrew the bolts and nuts. *Patent completed.*

1196. R. A. BROOMAN. *Improvements in spring mattresses, sofas, chairs, seats, and similar articles.* (A communication.) Dated May 12, 1863.

This invention relates to those mattresses, sofas, chairs, seats, and similar articles in which springs are employed, and has mainly for its object the fastening of the springs without the aid of strings, of sewing, or of nails as hitherto. At each corner of a frame of laths or plates the inventor fixes a vertical tube, and at each corner of a similar frame he fixes a vertical rod. He places one frame upon or over the other so that each of the vertical rods may enter one of the vertical tubes, and he retains the rods in the tubes by nuts, or by grooves formed on the tubes. He places helical or other springs between the two frames, and fixes them by means of claws formed on the laths or plates by a suitable tool or otherwise. Upon a person lying or sitting on the mattress or other article, the springs will be compressed, and the upper frame will descend to an extent proportionate to the weight it bears; and when the person rises the springs and upper frame will resume their original position. Or he forms mattresses, seats, and other articles of two boxes or cases without bottoms, one of which is free to slide in the other and retained therein by flanges; one of the boxes also carries flanges for supporting two frames of laths or plates between which the springs are held. The extent to which the upper box is permitted to descend upon a weight being put upon it, may be regulated by forming grooves in one box and corresponding projections upon the other box. He prefers to form the tubes employed as before described, in two parts, by cutting and stamping, and to connect the two parts by screws, rings, or otherwise. *Patent abandoned.*

1197. R. A. BROOMAN. *Improvements in machinery for preparing, dressing, and winding cotton, woollen, flax, silk, and other warps.* (A communicat[illegible] [illegible]ted May 12, 1863.

The characteristic features of th[illegible] the carrying on in one machine of [illegible] of taking the threads from the bobb[illegible] ing or winding on the warp beam; 2, [illegible] rangement of the racks or nests with [illegible] niding the threads and a brake com[illegible] 3, the gathering plate; 4, the a[illegible] ng cylinders with variable pres[illegible] f the revolving brush with in[illegible] drying or fanning of the t[illegible] r-forated with holes. The [illegible] ng machinery for preparing [illegible] on, woollen, flax, silk, and [illegible] described. *Patent compl[illegible]*

1198. H. RUSHTO[illegible] *[illegible]sses.* Dated May 13, 1863.

In carrying out [illegible] tw puffs, rolls, or ro[illegible] ed [illegible]

woven hair, intermittently at one end in a point; these points he connects by a piece of elastic material; the puff rolls are made to swell gradually from the pointed or upper ends, and then diminish toward the lower ends, where he also connects them by a piece of elastic material, thus forming an expanding circlet or band for the head, which instantly fixes itself in any required position thereon. To complete the said head dress, to the lower parts of the expanding puffs he attaches hair ringlets or roll curls, and when placed upon the head the front hair is turned back, over, and round the puffs, and fastened at the back; the artificial curls fall behind the ears, and thus form an elegant finish to the whole. *Patent abandoned.*

1199. R. A. Brooman. *Improvements in laying submarine telegraph cables.* (A communication.) Dated May 13, 1863.

This invention consists in connecting to the cables, as they leave the vessel from which they are paid out, buoys fitted as hereafter explained, and which, after a certain time, lose their buoying properties, whereby a nearly constant tension is maintained on the cable. In addition to the buoys, in some cases heavy weights are attached to cause the cable to descend to the bottom of the water in which it is being submerged. The buoys are, by preference, in the form of balloons of caoutchouc, or waterproof cloth, and when not extended occupy little space in the vessel. These buoys are provided with a tap, in which there are two ways, one for the admission of air, and the other closed by wire gauze for the escape of air; the wire gauze is covered by gum or other material which will dissolve after exposure to the water; and according to the nature and thickness of this covering, so will the air escape more or less quickly after the balloons have been submerged. The balloons are attached to a cord, the lower end of which carries a weight, and as the cable is leaving the vessel the balloons are attached by throwing or twisting the weighted end of the cord round it. Instead of balloons, or together with balloons, buoys in the form of parachutes may be connected to the cables in a similar manner to the balloons. *Patent completed.*

1200. H. Wilde. *Improvements in electro-magnetic telegraphs.* Dated May 13, 1863.

This invention consists of improvements in the indicating instrument described in the specification of letters patent granted to the present patentee April 8th, 1861, No. 858. In the indicator therein described, a revolving index is made to point successively to letters engraved upon a stationary dial. In the present improvement the dial, instead of being stationary, is made to revolve, and before it a magnifying glass or microscope of suitable size is so placed as to cause only the required letter on the revolving dial to be visible to the person receiving a message when the dial stops. *Patent completed.*

1201. T. Parkinson. *Improvements in machinery for weaving, sizing, dressing, and dyeing.* Dated May 13, 1863.

This invention consists—1, in certain improvements in the letting-off motion of looms for weaving; and 2, in agitating liquids employed in sizing, dressing, and dyeing by means of a screw revolving in the vessel containing the liquid. The invention cannot be described without reference to the drawings. *Patent completed.*

1202. F. Holthausen. *An improved portable copying press.* Dated May 13, 1863.

In carrying out this invention, the inventor constructs a strong rectangular box, open at one or both ends, and rather larger in length, breadth, and thickness than the book in which the letters or other papers are to be copied. A screw furnished with a winch-handle is mounted longitudinally in bearings fixed to the lower side or bottom of the box, and carries a screw nut, which, as the screw is turned, slides in a mortise formed in the centre of the bottom of the box, the said mortise forming a guide for the said screw nut. Inside the side box is placed a loose plate of iron or hard wood provided with a wedge, which is of the same size as, and fits into, the aforesaid mortise, the thin end of the wedge being immediately in front of the screw nut when in its normal position. This wedge is divided longitudinally in the middle to leave room for the screw. It will be evident that, upon turning the screw by means of the winch-handle, the screw-nut will be caused to advance, and, acting upon the wedge, will cause the loose plate to rise and exert a corresponding pressure upon the book or other article that may be placed between it and the top of the box. A metal plate covering the mortise is secured on to the bottom of the box below, serving as a point of resistance to the screw-nut, which rests on it, and thus preventing the bending downwards of the screw by the pressure. *Patent abandoned.*

1203. J. E. M'Connell and G. H. Bovill. *Improvements in the manufacture of thick plates of wrought iron for armour plates and other purposes.* Dated May 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1204. V. J. Cassaignes. *Improvements in stereoscopes.* Dated May 13, 1863.

This invention consists in colouring the prisms or lenses of stereoscopes so that each prism or lens presents several different tints or colours, and so that, consequently, the pictures or images seen through these glasses will appear under different aspects, giving, for example, the effects of morning, or of the sunrise, or of moonlight. *Patent completed.*

1205. C. L. Kensner. *Improvements in the manufacture of hydrate of barytes, and in the manufacture of sugar.* Dated May 13, 1863.

In order to manufacture hydrate of barytes suitable for being used in the manufacture of sugar, as hereafter described, carbonate of barytes is decomposed by subjecting it mixed with coal or charcoal, and a small quantity of a suitable flux (for which it is preferred to use an alkali or an alkaline earth) in an air or reverberatory furnace to a temperature commencing with about 800 degs. of Fahr., and raising the temperature up to a white heat. The charge is then to be drawn into a suitable receiver, and allowed to cool in the open air. When cool the charge is turned out the vessel; and water is to be gradually applied so as to slake the product, taking care not to apply too much water till the whole of the charge is slaked, when the charge is to be dissolved in water, and the solution, after being allowed to settle for a time, is fit to be employed in the manufacture of sugar as hereafter described. In order to obtain sugar from molasses, treacle, and other saccharine fluids, a solution of hydrate of barytes is mixed therewith, whereby a precipitate is obtained, which precipitate is to be mixed with water to which carbonic acid is to be applied in order to convert the barytes into a carbonate, which will precipitate and leave a syrup suitable to be treated in the ordinary manner to obtain crystals of sugar therefrom. *Patent abandoned.*

1206. B. Lambert. *Improvements in paper makers' rag or pulp engines.* Dated May 13, 1863.

For the purposes of this invention, in order more effectually and advantageously to carry off the water from a rag or pulp engine, a hollow partition is applied on the flow side of an engine, which divides the stream or flow of the stuff in the engine into two streams. The sides of the hollow partition are formed of sheet metal perforated with numerous holes, or of other suitable reticulated or perforated material. In addition to such hollow perforated partition, the side of the midfeather end of the engine or the flow side may, as has heretofore been proposed, be hollow and made suitable for straining off the water. In order more effectually to boil the stuff in a rag or pulp engine, provision is made for preventing the flow of air under the cover and above the stuff in the engine, which is ordinarily caused by the action of the breaking roller of the engine. This is effected by means of an axis or roller, having radial float boards, which axis or roller is above the fluid in the engine. At the end of the cover of the engine a flexible or yielding curtain is so arranged that the float boards which, as they revolve, dip into the stuff, are caused to move at a somewhat quicker speed than the flow of the stuff in the engine, whilst the air is prevented flowing under the cover and between it and the stuff by the float boards or paddles which are above the fluid, coming in succession against the flexible or yielding curtain. *Patent completed.*

1207. A. G. Southey. *Improvements in railway roof lamps, station, signal, and other fountain lamps.* Dated May 13, 1863.

This invention consists in adapting the above-named lamps to the use of the heavier portion of oils by means of a chimney supported over the flame, the lower edge of which is made to act as a deflector. *Patent abandoned.*

1208. J. Farmer. *Improvements in calendering, embossing, and other such machines used for finishing woven fabrics, part of which is applicable to drying machines.* Dated May 13, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1209. R. A. Brooman. *Improvements in the extraction of hydro-carburets from minerals in the distillation thereof, and in apparatus employed therein.* (A communication.) Dated May 13, 1863.

This invention relates to the extraction of hydro-carburets from mineral matters containing the same. The process of distillation is based upon—1, the generation of steam (as described); 2, its mode of action—that is to say, the perfect stability of its caloric, and its speed uniformly distributed (as described); 3, the volume of dry or desaturated steam (4,180 volumes for 1 volume of water), which produces quantities of oil in proportion to the space occupied by the steam; and 4, the employment of hydrogen and oxide of carbon for heating the retorts or coils, by which means the caloric is uniformly distributed, and may be increased or diminished by means of a tap, and by which the steam is allowed as long a course as may be necessary under the same conditions of heat, the loss produced by radiation being obviated, all as hereafter described. The steam gathers in its passage a quantity of oil in proportion, not to the quantity of the steam, but to the space passed over by it. The apparatus for carrying out this invention is constructed with the object of obtaining the greatest possible extent (longevité) of action of the steam on the matters under treatment on the one hand, and on the other to equalize its speed at all points, so that the calorific properties brought by the steam having to undergo no diminution nor increase in speed there shall be thermometric identity from the time of its admission up to the time of its exit, and that the cooling due necessarily to the work of the steam shall be uniformly spread over the whole apparatus; the loss of heat is easily compensated for by means of inflamed hydrogen, the quantity of which should be varied in direct ratio to the initial velocity of the steam. *Patent completed.*

1210. T. Lawrence. *Certain improvements in machinery or apparatus used in the processes or operations of drying, dressing, brushing, waxing, and finishing fabrics.* Dated May 14, 1863.

This invention consists—1, in an improved arrangement and combination of rollers and chambers heated by hot air or gas for drying fabrics; 2, in the application of a revolving bed heated by an admixture of air and gas for dressing or ironing fabrics; 3, in an improved arrangement and combination of a revolving disc containing wax with helically-formed revolving peg rollers and brushes for brushing, waxing, and finishing fabrics. *Patent completed.*

1211. J. Satchwell, W. H. Ashford, and C. Harrison. *Improvements in nails or rivets for boots and shoes, applicable to other purposes.* Dated May 14, 1863.

This invention consists in making from a round piece of wire a rivet with a raised head and threaded shank. Though applicable for other purposes the inventors design them as especially useful in the manufacture of boots and shoes, the soles and heels of which have hitherto been first united by means of nails with a flat or countersunk head, and rivets have been afterwards driven in. Now, by this invention, they construct such a nail or rivet as above described as to combine the two, so as to render one operation only needful where formerly two were necessary. *Patent abandoned.*

1212. A. Pilbeam. *Improvements in sewing machines.* Dated May 14, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1213. J. T. King. *Improvements in wicks for oil and other fluid burning lamps.* (A communication.) Dated May 14, 1863.

This invention consists in placing within an outer covering of woven fabric, or other flexible material, a quantity of loose or unwoven cotton, flax, rhea fibre, grass, or any other fibre or fibrous material, preferably combed, drawn, or worked into its or their greatest length or lengths, so that the power of raising the fluid in the container of the lamp to the point of combustion by capillary attraction may be increased. *Patent abandoned.*

1214. J. Burrell. *Improvements in the construction of cocks or valves.* Dated May 14, 1863.

In constructing cocks or valves according to this invention, a conical shell is employed, which, at its larger end, is made to adapt to the supply pipe or nozzle, and in the side of the shell is the outlet orifice for the passage or passages for the fluid to pass away from the cock or valve. Within the shell is a hollow plug turned and ground to fit it truly; this plug is open at its larger end for the fluid from the supply to enter it; at its smaller end it is closed, and this end projects out at the extremity of the shell, and receives a handle by which the plug may be turned, and by turning it, an opening in the side of the plug can be brought to correspond with the outlet passage in the shell. It will be seen that in this arrangement the pressure of the fluid in the supply pipe or vessel tends to press the plug into its seat in the shell and to keep it tight. *Patent abandoned.*

1215. G. Dowler. *An improvement or improvements in match boxes.* Dated May 14, 1863.

This invention consists in constructing match boxes with a spring striker on either the top, bottom, or end of the box. *Patent abandoned.*

1216. L. C. Chichester. *Improvements in machinery for weighing grain.* Dated May 14, 1863.

This invention consists—1, in a mode of hanging a swinging bucket that receives the grain, and tips the same out by swinging on its centres, and then swings back again to receive a fresh supply of grain; 2, in a mode of fitting a series of weights so that they shall be successively and gradually raised as the weight of grain causes the said bucket to descend, thereby avoiding any sudden motion or shock of the parts; 3, in an arrangement of cut-offs that check and finally stop the flow of grain from a hopper or spout into the bucket as the said bucket descends in consequence of the weight of grain deposited in such bucket; 4, in a peculiar construction of delivery-mouth at the lower end of the hopper or spout to arrest the momentum of the grain, and thereby ensure accuracy in the weighing operation, because the impetus of the descending grain is checked before reaching the scale; 5, in a peculiar catch for holding the bucket while being filled. The invention cannot be described without reference to the drawings. *Patent completed.*

1217. F. K. Eblam. *A new lubricating material or compound.* Dated May 14, 1863.

The inventor proposes, in the first place, to apply the material, known as plumbago or carbonate of iron, reduced to a state of impalpable powder. He also forms a compound by admixture of plumbago or carbonate of iron with prepared chalk, or the substance commonly known as French chalk. *Patent abandoned.*

1218. G. T. Bousfield. *Improvements in machinery for rolling, grinding, and cutting files and rasps.* (A communication.) Dated May 14, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1219. I. Parker. *Improvements in connecting and securing door and other knobs or handles to their spindles.* Dated May 14, 1863.

In carrying out these improvements, the patentee takes a spindle screwed from end to end with a suitable screw, the sides being squared down, as is well known and practised with door spindles of other constructions. He uses door knobs or handles of ordinary and well known shapes and materials, and upon one of such knobs or handles (which by preference he places outside the door) he fixes a plate of brass, or other suitable metal or material, which plate is perforated with one or more holes (or such holes or recesses may be formed in the knob or handle itself when made of suitable material) towards its outer edge, and having a central hole screwed inside into which the spindle screws as far as required. Sliding on the spindle by means of a square hole, but not turning round thereon, is a loose plate of suitable thickness, and (by preference) of the same diameter as the plate attached to the knob; and in the body thereof, towards the outer edge, there are one or more studs or pins which take into and fit the hole or holes in the door knob or handle. Other means may be adopted for catching or locking this plate to the plate fixed on the door handle or knob; but he prefers to employ the means above described. On the other knob or handle, which he places by preference inside the door, a plate of brass or other suitable metal or material is fixed as before; but instead of a hole or holes in such plate or knob (when the plate forms part of the knob), a square or oblong stud is fixed, which stud is made by preference of the same size as the square on the spindle. A plate or disc is attached to this knob, which plate or disc is cut nearly across by a slot of similar width to the square of the spindle, and at one end of the slot a round opening is formed wherein the spindle revolves when required, and when in position it slides on the square stud above referred to. When fixing the knob on to the spindle, the plate is slid sideways till the spindle revolves in the circular part of the slot, and the knob is screwed as far on as may be required; the plate is then pressed down on the stud until it comes to be concentric to the plate on the knob, when the slot then fits the square on the spindle, and causes the spindle to turn round on moving the knob or handle. The plate may be secured to or prevented from sliding upon the knob by means of a cover plate screwed on the door, or by set screws, or other suitable means. *Patent completed.*

1220. B. Shillito and D. Moor. *Improvements in generating heat and motive power.* Dated May 15, 1863.

In carrying out this invention, the patentees so form the furnace as to burn off the fuel within an air-tight enclosure, and force in, under the requisite pressure, the amount of atmospheric air necessary for effecting the combustion of the fuel. They regulate the emission or escape of the products of combustion from the furnace and flues or passages by means of a valve, damper, or regulator, or by valves, dampers, or regulators, capable of being closed air-tight: and the hopper-door, or other means of admitting the fuel into the furnace, is closed air-tight, to resist the requisite pressure. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated November 5, 1863.

2739. R. Smith, Glasgow, manufacturing chemist. Improvements in preparing or obtaining colouring matters.

Dated November 9, 1863.

2786. R. H. Philipson, agent, and J. Dees, engineer, Cassop, Durham. An improved machine adapted for performing various mining operations, such as working or cutting coal or other analogous substances in mines, forcing water from mines, and air thereunto.

Dated November 14, 1863.

2846. E. Hargraves, Manchester. Improvements in preventing the escape of heat from steam boilers and other heated surfaces.

2857. J. Harrison, Kingston-upon-Hull, seed crusher. Improvements in mills for cleaning cotton seed.

Dated November 16, 1863.

2862. J. Hulse and J. Lawrence, Willenhall, Stafford, wood turners. An improved mode of attaching door knobs to their spindles.

2867. E. W. Elmslie, Great Malvern, architect. An improved and economical construction of cottages, applicable also to various other descriptions of buildings.

Dated November 19, 1863.

2898. J. Elder, Glasgow, engineer. Improvements in steam engines.

2901. I. Francis, Pen-y-gelli, near Wrexham. Improvements in, and apparatus for, washing, cleaning, and separating impurities from small coal, coke, ashes, or cinders.

2903. J. Kirkham, Euston-road, civil engineer. Improvements in the treatment of certain ores of iron.

2904. E. Walker, London-street, windlass manufacturer. Improvements in windlasses.

2905. J. Collyer, Leman-street, Whitechapel, manufacturing cooper. Improvements in the mode of, and apparatus for, stopping or closing orifices in casks and other vessels.

2906. R. and J. S. Walker, Bury, machinists, and B. Brown, mechanic. Improvements in machinery for preparing cotton to be spun.

2907. E. Christmas, Watford, Hertfordshire. Improvements in carriages.

2908. W. Symons, 17, St. Mark's-crescent, Regent's-park, philosophical instrument maker. Improvements in the construction and working of railways.

2909. B. Gooch, 4, Bridge-street, Westminster. Improved wrought-iron sheeting piles.

2910. J. Colling and D. G. Pinkney, Seaham, Durham, master mariners. Improvements in apparatus for reefing and furling ships' square sails.

2911. W. B. Hodson, Cotton-street, Bow-common, metallic cask maker. Improvements in the manufacture of metal drums and cans for holding oils and other fluid matters, and in furnaces used in such manufacture.

Dated November 20, 1863.

2912. G. Rait, Canal-bridge, Kingsland-road, managing director of the Gas Meter Company, and J. Winsborrow, 23, Castle-terrace, Pownal-road, Dalston, foreman. Improvements in the construction of dry gas meters, and in the means or apparatus employed therein.

2913. J. Seward, Clitheroe, Lancashire, and H. Smith, Enfield. An improved apparatus for preventing incrustation in steam boilers.

2914. E. Marwood, Blackburn, cork manufacturer. The application of a certain substance or material for covering rollers used in spinning and preparing cotton, wool, and other fibrous substances to be spun.

2915. B. Dodson and E. Barlow, Bolton, machine makers, and P. Knowles, foreman. Improvements in machinery for ginning cotton and for opening cotton and other fibrous substances.

2918. A. H. Ferry, merchant, 2, Rue Ste. Appoline, Paris. Improvements in making hammers for pianofortes.

2919. J. J. Hays, Hitchin. Improvements in hot-air stoves.

2920. G. S. Kirkman, 27, Claremont-terrace, Fentiman's-road, civil engineer. Improvements in apparatus used for connecting railway carriages and trucks.

2921. T. Brinsmead, St. Giles-in-the-Wood, near Torrington, Devon. Improvements in apparatus for thrashing and reeding wheat and other straw.

2922. A. McLaine, Belfast, ship builder. Improvements in the construction of gun boats, gun vessels, and rams.

2923. G. Fawcus, North Shields, shipbuilder. Improvements in connecting scaling, firing, and other like ladders.

2924. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the construction of fan blowers for ventilating and other purposes. (A communication.)

2927. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in steam engines and in apparatus connected therewith. (A communication.)

Dated November 21, 1863.

2928. C. E. Wright, Colville-terrace, Sherwood-street, Nottingham, mercantile traveller. Improvements in apparatus for clipping or binding together letters, music, and other loose sheets.

2929. T. Turner, Glasgow, architect and civil engineer. An improved fire-proof floor or roof for buildings, bridges, and other structures.

2931. F. Fenton, Camberwell. Improvements in the treatment of vegetable fibres for the production of paper pulp or half stuff therefrom.

2932. W. Williams, Stanley, Liverpool, brickmaker. Improvements in machinery for making bricks and other like articles.

2933. D. Cope, Liverpool, oil merchant. Improvements in the manufacture of metallic drums, kegs, casks, and like cylindrical packages.

2935. E. Finch, Bridge Works, Chepstow. Improvements in constructing the floors of bridges, houses, and other buildings.

2936. F. Watkins, London Works, near Birmingham. Improvements in machinery for the manufacture of bolts, nuts, spikes, and rivets, and also in furnaces for heating blanks to be formed into such articles.

2939. D. W. Hamper, Newcastle-upon-Tyne, brewers' engineer. Improvements in apparatus for mashing malt for brewing or distilling.

2940. M. B. Westhead, Manchester, manufacturer and merchant. Improvements in adapting or arranging tapes and other such narrow fabrics and threads for use.

Dated November 23, 1863.

2942. W. Bestwick, Manchester, braid manufacturer. Improvements in braiding machines.

2944. P. Bawden, Queen-street, Cheapside. Improvements in machinery for making bricks.

2945. J. Smith, Liverpool, painter. An improved composition for coating or covering the bottoms of ships.

2946. E. B. Wilson, 10, Strand, engineer; and J. Imray, 190, Westminster-bridge-road. Improvements in presses.

2947. T. Carr, New Ferry, near Birkenhead, engineer. Improvements in machinery for amalgamating or intermixing, dry, semi-fluid, or aqueous materials, and for agitating solids with liquids for combining, dissolving, or washing the same.

Dated November 24, 1863.

2949. G. W. Yapp, 16, Clement's-inn. Improvements in the preservation of animal substances. (A communication.)

2951. D. W. Rea, Upper Thames-street, provision merchant. Improvements in preserving animal and vegetable substances.

2952. W. Howlett, 16, Cottage-grove, Mile-end-road, commercial clerk. Improvements in printing floor cloths, carpets, and similar goods, and in the machinery or apparatus to be employed therein.

2954. G. Davies, 1, Serle-street, Lincoln's-inn, civil engineer. Improvements in photography. (A communication.)

2955. J. Lewis, 5, Wych-street, Strand, engineer and model maker. Improvements in driving sewing machines, which improvements are also applicable for driving other machinery.

2956. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in rotary engines. (A communication.)

2957. R. Furnival, Manchester, machinist. Improvements in braiding machines.

2958. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in machinery for breaking and cleaning flax, hemp, and other fibre-yielding plants. (A communication.)

2959. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in balloons or aeronautic apparatus. (A communication.)

2960. J. Sibert, 9, Carter-gate, Nottingham. Improvements in the manufacture of joined blond, and in the machinery employed therein.

2961. P. Tait, Limerick, Ireland. Improvements in apparatus used for pressing and ironing garments.

2962. C. L. Daboll, Aldersgate-street. Improvements in marine fog signals or alarums.

Dated November 25, 1863.

2963. G. Parkin, Tryddyn, engineer. Improvements in apparatus employed in the manufacture of paraffine and other like oils from shale, cannel, and other like minerals.

2964. T. Wilson, Birmingham, mechanical engineer. Improvements in presses for cutting, perforating, and shaping metals.

2965. M. Power, Worcester, head constable of City Police. Improvements in fire-escapes.

2967. L. Accarain, Mons, Belgium, merchant. Improvements in the manufacture of paper, thread, cordage, and fabrics from beetroot.

2968. J. H. Wilson, Liverpool, brass founder and ships' ironmonger. Improvements applicable to ships' and other lift pumps.

Dated November 26, 1863.

2969. H. B. Barlow, Manchester. Certain improvements in looms for weaving. (A communication.)

2970. D. Kircaldy, Glasgow, engineer and draughtsman. Improvements in testing or measuring the strength and other properties of various materials and structures, and in apparatus therefor.

2971. R. Laming, Priory-road, Kilburn. Improvements in preparing materials useful in the purifying of gas from sulphuretted hydrogen, carbonic acid, and ammonia, and in making ammoniacal compounds.

2972. J. Thorpe, Whittle's Croft, London-road, Manchester, manufacturer. Improvements in the mode of marking patterns or designs upon gored and straight skirts and skirtings to serve as a guide for sewing and embroidering thereon.

2973. J. Simmonds, Holland-street, Clapham-road, plumber. Improvements in stink traps for water-closets, sinks, and other purposes.

2974. J. Baker, Temple-street, Whitefriars. Improvements in compositions applicable to the coating of ships' bottoms.

2975. J. Nadal, 14, Brooke's-market, Brooke-street, Holborn. Improvements in apparatus for raising and forcing fluids.

2976. J. S. Jarvis, Wood-street, City, warehouseman. An improved shirt collar.

2977. J. Ulsterman, Sheffield, manufacturer. Improvements in frames for umbrellas and other like articles, and petticoats or skirts.

Dated November 27, 1863.

2979. W. C. Brocklehurst, Macclesfield, silk manufacturer, and J. and J. Creighton, Manchester, machinists. Certain improvements in machinery or apparatus for winding yarns or threads.

2980. T. Gray, Mitcham, bleacher. A new method of discharging colour from rags used for paper-making or other purposes, and in the treating of vegetable fibres by such process.

2981. F. Page, Birmingham, bank accountant. Improvements in furnaces and apparatus for the manufacture of volatile hydro-carbons, which improvements are also in part applicable to furnaces and apparatus for the manufacture of illuminating gas.

2982. J. B. and D. Bateman, Bradford. Improvements in sewing machines.

2983. C. Crabtree, Bingley, Yorkshire, spool tube manufacturer. Improvements in the manufacture of paper spool tubes.

2984. J. Clark, Manchester, airproof and waterproof fabric manufacturer. Improvements in looms for weaving elastic fabrics.

2985. J. Clark, Manchester, airproof and waterproof fabric manufacturer. Improvements in machinery or apparatus for cutting strips or threads of india rubber or other materials.

2986. E. Gardner, Manchester, loom maker and machinist. Improvements in looms for weaving elastic fabrics.

2987. H. Hirzel, doctor of philosophy, and lecturer on chemistry and pharmacy, Terminus Hotel, London-bridge. Improvements in extracting essences and perfumes and also oils and fats from matters containing them, also in bleaching and purifying oils and fats, and in apparatus employed therein.

2988. S. and T. Smith, 5, Fell-street, City, wholesale confectioners. Improvements in composition or means for the purpose of destroying insects by fumigation and in means or apparatus employed therewith.

2989. P. Gaskell, Walsall-road, Birmingham. Improvements in tell-tales or indicators for cabs and such like public vehicles.

Dated November 28, 1863.

2990. E. Bevan and W. S. Weare, Birkenhead, watch-manufacturers and copartners. Improvements in and applicable to watches to obtain or produce independent centre seconds.

2991. C. Cordon, Nottingham, plumber. Improvements in means or apparatus for supplying water to water-closets and urinals.

2992. E. Ironmonger, 1, Friar-gate, Derby, auctioneer, upholsterer, and furniture dealer. Improvements in the means of fitting together or connecting articles or parts of articles.

2993. T. Lane, Cirencester, implement maker. Improvements in chaff-cutting machinery.

Dated November 30, 1863.

2994. A. Etienne, Great Portland-street, Oxford-street. Improvements in the construction of carriages and vehicles, and of wheels applicable thereto.

2995. A. Albini, Birmingham, Captain in the Italian Navy. Improvements in ships of war and in arming ships of war.

2996. G. A. and G. A. Thompson, upholsterers, and J. Latham, patent lock maker, Birmingham. Improvements in the manufacture of door springs, part of which said improvements are applicable to the manufacture of weighing machines, steelyards, scale beams, and other articles of like nature.

2997. W. Campion and G. Wilson, machine builders, and A. Wilson, hosiery manufacturer, Nottingham. A new or improved self-acting time register.

2999. J. Chalmers, 5, Wellington-road, Kentish-town. Improvements in guns and gun projectiles.

3000. E. W. James, Brynllys, near Aberystwyth. Improved apparatus for drilling or boring rock and other earthy substances, for exploring and other purposes.

3002. J. M. Ollis, Plymouth, chief engineer. Improvements in apparatus for obtaining fresh water from sea water.

3003. C. Pontifex, St. Paul's-road, Islington, vat and back maker and patent refrigerator manufacturer. Improvements in the construction of sluices and other cocks or valves, and in the means of connecting them and the ends of flexible hose pipes together.

3004. J. E. and E. H. Blundon, Fleet-street, portmanteau and travelling-bag manufacturers. Improvements in the construction of letter, tourist, despatch, and other similar bags or receptacles.

Dated December 1, 1863.

3005. E. M. Boxer, Royal Arsenal, Woolwich, Lieut.-Colonel Royal Artillery. Improvements in fuses and shells for ordnance.

3006. H. Wilde, Manchester, engineer. Improvements in the construction and working of electric telegraphs, and in apparatus connected therewith, partly applicable to other purposes.

3007. P. G. Gardiner, New York, United States. An improvement in railroad car springs.

3008. R. Brailsford, Knowsley, Lancashire, trainer of dogs. Improvements in the construction of vermin traps.

3009. B. Jones, Warrington, manufacturing chemist. Improvements in separating sulphur from alkali waste.

3010. G. J. Doddrell, Glasgow, North Britain, sugar refiner. Improvements relating to the manufacture or refining of sugar.

3011. W. E. Gedge, 11, Wellington-street, Strand. Improved plough. (A communication.)

3012. J. G. Redman and G. Martin, Brompton ... provements in compounds or compo itions for coa... covering iron or wooden ships and vessels, metallic ... ing, telegraph cables, and other objects, to prese... from decay, fouling, or other destructive action.

3013. H. Lumley, Chancery-lane, Associate of th... tution of Naval Architects. Improvements in a... for steering.

3014. R. Turnbull, Portsmouth, shipbuilder. Improvements in sheathing iron vessels and armour-plated ships.

3015. W. Clark, 53, Chancery-lane, engineer. Improvements in apparatus for lighting and heating. (A communication.)

3016. E. A. Inglefield, Her Majesty's ship "Majestic," Captain in the Royal Navy, F.R.S. and F.R.G.S. Improvements in apparatus for mounting and working guns used in ships and other floating vessels, and in fortifications.

3017. G. Glover, Ranelagh Works, Ranelagh-road, Pimlico. Improvements in dry gas meters.

3018. J. Thom, Hull, mechanic. Improvements in apparatus to be employed in expressing oils and fatty matters.

3019. T. Mallinson, Globe Works, Manchester, machine maker. Improvements in certain self-acting mules for spinning and doubling cotton and other fibrous materials.

3020. S. B. Cochran, 9, Catherina-terrace, Lansdowne-road, Clapham-road, machinist. Improvements in sewing machines, and in apparatus connected therewith.

Dated December 2, 1863.

3021. G. Macfarlane, Draycott-street, Chelsea, professor of music. A new and improved ink regulator and indicator.

3023. W. Wilson, Manchester, ironmonger. Improvements in generating gas for illuminating and other purposes, when made by passing atmospheric air over or through volatile oils, and treating such gas and the gas made from coal or cannel, after leaving the generators, so as to improve the heating and illuminating qualities thereof, and in the apparatus for effecting the same.

3027. A. W. Haley and A. Bingham, engineers and machinists, and R. Webster, mechanic, Manchester. Improvements in machinery or apparatus for making envelopes and other similar purposes.

3031. J. Harper, Aberdeen, fence maker. Improvements in pillars and apparatus for straining wire.

3033. J. Cutler, Gloucester-road, Upper Holloway. Improvements in apparatus for lighting and ventilating.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated December 5, 1863.

3059. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. Improvements in fret saws.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, December 15, 1863.

1884. J. W. Branford. Agricultural implement.
1901. W. Cotton. Looped fabrics.
1910. T. Fellowes and H. Hempey. Apparatus for elevating straw.
1911. J. E. Vanner. Umbrellas and parasols.
1928. E. A. Cowper. Furnaces.
1929. G. Clark. Construction of ships.
1931. W. Storer and J. Hancock. Electromotive engines.
1933. W. Hodson. Propelling carriages and vessels.
1937. J. E. Dowson. Rolled metal plates.
1940. J. Fenwick. Self-acting valves.
1941. J. Young. Preservation of animal matter.
1942. W. Clark. Ovens. (A communication.)
1944. G. E. Charageat. Frames for umbrellas.
1945. E. E. Quelle. Inkstands.
1946. J. Kirkham. Apparatus for generating heat.
1947. T. Simmelkiar and J. I. Spicer. Composition for the bottoms of ships.
1949. W. Jones. Steam boilers.
1951. A. V. Newton. Shuttles. (A communication.)
1952. J. W. Slater. Yellow and orange colouring matters.
1957. T. W. Guillod. Chessboards and chessmen.
1959. J. Thompson, E. G. and F. A. Fitton. Engines for carding cotton.
1960. N. Jarvie and W. Miller. Oakum.
1964. H. R. Brown. Apparatus for the regulated delivery of cards, tickets, labels, &c.
1965. M. Smith. Obtaining farinaceous material from potatoes.
1966. J. W. Armstrong. Securing the rails of railways.
1967. J. A. Fullarton. Fastening hoops for packing bales.
1970. R. Dickson. Lithographic printing presses.
1976. W. Knowles and R. Halliwell. Spinning and doubling cotton.
1982. W. Clark. Road sweeping machines. (A communication.)
1983. J. Wheeler. Perfuming of gloves.
1991. J. Templeman. Artificial fuel.
2010. R. B. Greenwood. Preventing accidents upon railways.
2016. N. S. Russell. Working great guns.
2017. J. Wain. Doubling or twisting yarns.
2037. A. M. Dearn. Mashing machine.
2045. J. Arthur. Apparatus for the cure of hernia.
2052. R. A. Brooman. Hats, caps, and bonnets. (A communication.)
2053. R. A. Brooman. Treating molasses, syrups, &c. (A communication.)
2096. F. R. Stack. Military bridges, piers, &c.
2126. E. Amoureus. Separating solid from fluid fecal matters.
2159. W. Clark. Hydraulic apparatus. (A communication.)
2177. N. Bailly. Application of rolling friction to axle-boxes. (Partly a communication.)
2201. A. V. Newton. Directing motion in right lines. (A communication.)
2214. J. Lillie and J. H. Waite. Preservation of surfaces of iron, wood, and other materials.
2229. J. H. Wilson. Side lights for ships.
2287. P. McLaurin. Drying paper.
2293. I. Baggs. Preserving the hulls and bottoms of ships.
2621. A. V. Newton. Railway wheels. (A communication.)
2[illegible]. F. Parker. Carriages.
2651. T. Grason. Boots, shoes, and clogs.
2359. W. and S. Firth and J. Sturgeon. Cutting and boring coal, stone, or other minerals.
2716. J. Macintosh. Taps or cocks.
2760. W. D. Allen. Casting ingots of steel.
2822. L. E. O. Martin. Generating steam.
2827. B. Marriott and C. Radcliff. Watches.
2865. S. Cameron and W. Johnston. Taps or valves.
2874. C. W. Harrison. Filters.
2898. J. Elder. Steam engines.
2901. I. Francis. Washing coal, coke, &c.
2926. H. A. Bonneville. Preserving grain. (A communication.)
2941. J. Steart. Extracting fibre from zostera marina.
2955. J. Lewis. Driving sewing machines.
2958. W. E. Newton. Breaking and cleaning flax. (A communication.)
2967. L. Accarain. Paper, thread, cordage, and fabrics from beetroot.
2970. D. Kirkaldy. Measuring the strength of materials.
2998. M. R. Pilon. Firearms.
3059. H. A. Bonneville. Fret saws. (A communication.)

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed December 8, 1863.

1348. E. Ironmonger.

Sealed December 11, 1863.

1462. J. Johnson and W. Braithwaite.

Sealed December 12, 1863.

1482. R. Blackburn.
1498. R. W. Gordon.
1505. J. Lightfoot.
1505. J. G. Jennings and M. L. J. Lavater.
1508. J. Steele and W. Mason.
1510. W. Neill.
1511. J. C. Onions.
1512. R. A. Brooman.
1519. F. de Wylde.
1527. D. Barker.
1537. A. Morel.
1538. A. Morel.
1559. W. Clark.
1539. W. Clark.
1582. W. L. and T. Winans.
1584. W. L. and T. Winans.
1585. E. Brooks.
1596. A. E. Brae.
1612. J. Griffiths.
2348. H. Haigh and R. Heaton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3004. B. G. George.
3008. G. Davies.
3027. R. Davison.
3031. W. E. Newton.
3038. J. Townsend and J. Walker.
3039. A. Verwey.
3051. G. S. Harwood.
3054. A. Kyle.
3057. J. Casson.
3071. J. Chubb and E. Hunter.
3079. W. E. Newton.
3084. G. Davies.
3096. E. Barlow, J. Newhouse, and F. Hamilton.
3129. G. Hadfield.
3150. W. Clark.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2923. W. and T. Storey.
2940. W. Lund.
2950. J. T. and E. P. Wright.

LIST OF SPECIFICATIONS PUBLISHED.

For the Week ending December 12, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
872*	0 8	838	0 10	864	0 8	876	0 4	893	0 4	907	0 8
808	0 10	840	0 8	865	0 10	877	0 4	894	0 4	908	0 4
823	0 4	841	0 4	866	0 4	880	1 10	896	0 4	909	0 4
825	1 10	848	0 10	867	0 4	882	0 4	897	0 4	910	0 4
827	0 4	852	1 6	868	0 4	883	0 4	898	0 4	911	0 4
828	0 4	857	3 4	869	0 4	886	0 4	900	0 4	912	0 4
829	0 4	858	0 4	870	0 10	887	0 4	901	0 4	913	0 8
83[illegible]	1 2	859	0 4	871	0 4	888	0 4	902	0 8	914	1 4
831	0 4	860	0 4	872	1 0	889	0 8	903	2 6	915	0 4
835	0 10	861	0 4	873	0 4	890	1 6	904	0 8	916	0 8
836	0 10	862	0 4	874	0 10	891	1 4	905	0 4	917	0 10
837	0 10	863	0 4	875	2 0	892	0 4	906	0 8		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	pr ct
IRON:—					
Welsh Bars, in London	per ton	7 15 0	to	8 0 0	2½
Nail Rods	do	8 5 0		8 15 0	
Hoops	do	10 10 0		0 0 0	
Sheets, single	do	£11 10 0		0 0 0	
Staffordshire Bars	do	9 10 0		0 0 0	
Bars, in Wales	do	6 15 0		7 0 0	
Rails	do	7 0 0		0 0 0	
Foundry Pigs, at Glasg. No 1	do	3 3 0		3 7 0	
Swedish Bars	do	12 0 0		12 10 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		16 10 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	105 0 0		0 0 0	
Hammered Bottoms	do	115 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	110 0 0		0 0 0	
Tough Cake and Ingot	do	94 0 0		0 0 0	
Tile Copper	do	94 0 0		0 0 0	
Best Selected	do	1[illegible]1 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 1[illegible]		0 0 0	
Yel. Metal sheathing & Rods	do	0 0 8½		0 0 9	
Fine Foreign	per ton	1[illegible]0 0 0		102 0 0	
TIN:—					
English Block	per cwt.	5 12 0		0 0 0	2½
do Bar	do	5 13 0		0 0 0	
do Refined	do	5 17 0		0 0 0	
Banca	do	5 16 0		5 17 0	nett
Straits	do	5 13 0		5 15 0	
SPELTER:—					
On the spot	do	18 10 0		18 15 0	nett
ZINC:—					
English Sheet	do	21 10 0		2[illegible] 0 0	2½
QUICKSILVER	per btl.	7 0 0		0 0 0	3
REGULUS OF ANTIMONY:—					
French star	per ton	3[illegible] 0 0		0 0 0	2½

TIMBER, duty 1s. per load, drawback 1s.

	£ s.	£ s.		£ s.	£ s.
Teak ... load	£13 0	£13 0	Archangel, yellow	£13 0	13 10
Quebec, red pine	3 10	4 10	St. Petersburgh, yel.	11 10	12 0
" yellow pine	3 10	4 10	Finland	9 0	10 0
St. John, N.B., yellow	0 0	0 0	Memel	10 0	13 0
Quebec oak, white	5 10	6 10	Gothenburg, yellow	10 0	11 0
" birch	3 10	4 10	" white	9 0	9 10
" elm	3 10	5 0	Gefle, yellow	10 10	11 10
Dantzic oak	3 10	6 10	Soderhamn	9 10	10 10
" fir	2 10	3 10	Christiania, per C., 12ft. by 3 by 9 in.		
Memel fir	3 5	3 10	Christiania, yellow	21 0	23 0
Riga	3 0	3 5			
Swedish	2 10	2 15	Deck Plank, Dantzic, per 40 ft. 3 in.	0 14	1 1
Masts, Quebec red pine	5 0	6 0			
" yellow pine	5 0	6 0	PUMICE STONE pr ton	5 10	9 0
Lathwood, Dantzic, fm	5 10	6 10	OILS, &c.		
" St. Petersburg	8 0	8 10	Seal, pale ... per tun	47 10	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Sperm body	75 0	78 0
			Cod	54 0	0 0
			Whale, Sth Sea, pale	45 0	46 0
Quebec, white spruce	15 10	18 10	Olive, Gallipoli	58 0	58 10
St. John, white spruce	14 0	15 10	Cocoanut, Cochin	47 0	0 0
Yellow pine, per reduced C.			Palm, fine	36 10	0 0
			Linseed	36 0	0 0
Canada, 1st qual.	17 0	18 0	Rapeseed, Eng. pale	40 0	0 0
" 2nd do.	11 0	12 0	Cottonseed	30 10	37 0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

Contents of the Last Number.— Page

THE
MECHANICS' MAGAZINE.

LONDON, THURSDAY, DECEMBER 24, 1863.

BREAD-MAKING MACHINERY.

ONE of the most important trades carried on in London is the baker's; not because great sums are invested, or great numbers employed, in the production of bread, but because of the relation which the baker bears to every other member of the population, from the highest to the lowest. "Bread is the staff of life," says the old proverb; and it behoves us to see that it does not conceal the sharpness of death, or at least a certain amount of misery, which it is very unpleasant to contemplate. The wholesomeness or unwholesomeness of the chief constituent of our meals, rests in the hands of the baker; to his honesty we must trust for the absence of adulteration, and the good quality of the ingredients employed; and, as we all eat bread, and eat it in quantity, the labours of the baker influence the public health and comfort very materially; more so, perhaps, than those of any other trade. A French physician once attributed a goodly proportion of the crimes committed in the world, to the dyspeptic influences of bad food. Without going quite so far, we may point out that the absence of pure food is generally accompanied by crime. It is not those who are utterly destitute, who run away with our plate, garotte us in the streets, or do murder in our quiet English lanes. There is something essentially demoralizing about filth and bad victuals, and therefore we say that it is by no means unlikely that the baker exerts a more powerful indirect moral influence, than he receives credit for, from any one save the metaphysician.

Most of our readers have heard of Mr. Tremenheere and his labours in the cause of the journeymen bakers of the metropolis—labours set on foot by desire of the Home Secretary, to investigate a statement made by these men, regarding the conditions under which they carried on their labours. Barely eighteen months have elapsed since Mr. Tremenheere's report, with all its sickening details, was laid at the feet of the London world. The little blue book was called disgusting, because the author spoke of things as he found them; the greatest defect which could be urged was, that Mr. Tremenheere was too explicit. It would have been better, perhaps, had he been more so. We cannot well conceive of any occupation more unhealthy than the baker's. The white face, the ghastly look, the short cough, point out the evil influences at work, in a shape not to be overlooked. Dr. Guy states that no class of men, save, perhaps, the Redditch needle-grinders, are liable to so severe and often fatal diseases of the chest. Forty-two years is rather over the usual age when death comes for the prey prepared for him among these men. By that time, late hours, overwork, and an atmosphere so poisoned as to prove deadly to the unseasoned, have done their work; and thus the average life of the men, on whose exertions so much of our comfort, not to say our existence, depends, is far below that of any other trade connected directly with the supply of the more immediate wants of the civilized Englishman.

But if the present system is bad for the operative, what is it for the public at large? We must refer our readers to the blue book for the answer. The details have been often placed before the world. They are far from inviting, and will scarcely bear repetition. The English public is now and then accused of being fastidious. Were it so in the matter of bread, a crusade would have been proclaimed long ago, which would have resulted in the lapidation of the master bakers. John Bull does not so much mind as he ought, the mere aural evidence which may be brought to him of dirt and misery. Unless he see it with his own eyes, he rather refuses to be affected by the testimony of others; and thus our bread continues to be made in such places as these :—"The principal fact which struck me," says Mr. Tremenheere, "was the extreme dirt. In many cases the spaces between the rafters were covered with cobwebs, hanging so closely that a heavy footfall above, must bring large fragments down into the dough beneath. Animals in considerable numbers crawled in and out of the troughs in which the bread was made, and on the walls. The smells from the drains, &c., were very offensive; the draught of the oven continually drawing the effluvia through the bakehouse; and in every case there was a total absence of ventilation. Rats and mice, of course, abounded." This, be it remarked, is not an isolated case. Mr. Tremenheere met with many such. No man can tell whether he is, or is not, supplied from just such an establishment, and in this lies the real secret of the continuance of the system. The public do not believe that the state of affairs is really so bad, and therefore they eat in faith, instead of regarding food so prepared with loathing.

It is a very remarkable fact that an operation so purely mechanical as the mixing and working of dough should continue to be performed by hand. There is no idea more hackneyed than that of performing every conceivable process in the arts by the aid of machinery. It is the absurdity of the day. There are many branches of manufacture in which the most perfect mechanism cannot produce, *for the same money*, the effects of the human hand guided by the brain. There are countless instances wherein machinery cannot at all perform what is required. There is no occasion to cite examples—they are more or less familiar to all. Before, therefore, we join in the insensate cry for those combinations of wheels, levers, and screws, which we are too often pleased to call a machine, let us see whether any process under consideration can really be performed in the best manner by such means; or, granting so much, it is well to examine the problem from a pecuniary aspect, and pronounce judgment accordingly. The mixing of a certain quantity of flour with a certain weight of water, is a process as simple as can be conceived—capable, too, of being performed by extremely simple and well-known mechanical appliances, involving no intricacies of any kind. For this reason, hand labour is one of the worst means which can be applied to the desired end. The practicability of making dough after an improved fashion does not rest on mere assertion. It has been so made both in France and Great Britain for many years. The manufacture of ships' biscuit by machinery has been carried on at Gosport since 1831, when Messrs. Rennie erected the necessary apparatus in order to supply the growing demand for better stores in the Navy. The proper quantities of flour and water are placed in a large circular trough, traversed by a shaft armed with knives or blades, which effectually mix the ingredients by their rotation. Four hundred and fifty pounds of dough are mixed in this way in the space of six minutes. Subsequently, the mass is conveyed to the "breaking-down rollers," as they are termed. These rollers, two in number, about 5 ft. long, and weighing 15 cwts. each, travel backwards and forwards on an iron table or platform, on which the mixed, but unkneaded, dough is placed. These rollers are fitted with spindles at the ends, which revolve in suitable bearings made in the jaws of two forked connecting rods, one for each roller. A large crank shaft at some distance from the kneading table puts the rollers in motion over the dough spread beneath them. The first roller is channelled in a peculiar manner on the surface, so as to break up the smallest lumps; the second is perfectly smooth. Each is fitted with a "doctor" to keep the surface clean. Five minutes suffices to knead 450 lbs. of dough perfectly; the mass being submitted successively to the action of each roller. The sheet of dough is finally cut into hexagonal biscuits by the action of a stamping press. A few minutes' exposure to the heat of an oven serves to complete a process which is perfectly cleanly in its details. Some years since a Mr. Stevens brought out a dough-kneading apparatus somewhat similar in its general construction, which is employed to some extent in the metropolis in making the fermented bread, and regarded with considerable favour.

From the earliest ages, ferments of some kind have been deemed absolutely necessary to the manufacture of true bread, as distinguished from biscuit and its varieties. There is something still to be explained in the peculiar effect which ferments produce on the flour of wheat and rye, the only true bread-making cereals. A certain destructive action is called into play, which results in the formation of a considerable quantity of carbonic acid, to which the light vescicular quality of good bread is due. In addition to this, all the sugar, or nearly all, contained in the wheat, is converted into alcohol, and attempts have been made, ere now, to make the baker's oven perform the part of a still as well; but with very limited success. Spirit of good quality has been produced, it is true; but the nature of the process precludes ventilation, and the bread, as a consequence, acquires a peculiar flavour, too decided to permit it to remain palatable. The loss of the sugar always follows as a result of the use of yeast, and the nutritive qualities of the bread are thereby depreciated. Many attempts have been made from time to time to do away with the use of barm, by the substitution of certain acids and alkalies, whose combination should supply the necessary quantity of carbonic acid gas. The use of such materials is, however, objectionable from various reasons. They all leave neutral salts behind in the bread, which we are better without; and being very subject to adulteration, their use may lead to possibly fatal results without a vast deal of care. The baker's shop is a bad chemical laboratory. Besides, none of these things can do away with that process of manipulation which Mr. Tremenheere has placed before us in such an objectionable light. About three or four years ago, Dr. Dauglish patented a method of making bread by which the use of ferments is totally avoided; the labours of the baker, or rather the bread-maker, reduced to a minimum; and manipulation of any kind entirely got rid of. As a result, the bread produced, is at once clean, pure, and possessed of all its nutritive qualities in the highest degree.

The principle involved, like that in most other good mechanical contrivances, is extremely simple. Taking advantage of the well-known capacity of water for absorbing carbonic acid, whatever its density, in quantities equal to its own bulk, Dr. Dauglish first prepares the water which is to be used

in forming the dough, by placing it within a strong vessel, and forcing carbonic acid gas into it by the aid of a pump put in motion by a small steam engine. The gas is formed by the action of very pure sulphuric acid on chalk, placed within the vessel J, shown in the engraving on another page. The gas is subsequently washed by passing it through water, and ascends into the gasometer A, from which it is pumped, as occassion requires, into either of the vessels marked B, within which it is combined, under a pressure of about 100 lbs. on the square inch, with the water, which absorbs it without any appreciable increase in bulk, and, of course, retains the gas so long as it is kept under pressure, and not one moment longer. The flour, and salt in the form of brine, are conveyed by the shoot C and a tube not shown, into the hemispherical vessel D. As soon as the necessary quantity has been introduced, the valve is closed through which the flour entered. A cock is turned, and a measured quantity of aerated water admitted, or rather forced, by high pressure, into D. A system of knives rotating within, effectually kneads the mass. After a little time a dough tap, as it is called, at E, is opened, and the contents of the vessel expelled in a continuous stream by the pressure within. Here it is that the most remarkable part of the process occurs. The close vessels, the gasometers, the pump, have only been means to this end. As the mass leaves the tap it expands, by virtue of the escape of the gas imprisoned in the water the instant before, into a light frothy dough, which is cut off by an attendant, as shown in the second engraving, weighed, and transmitted to the oven without coming in contact with the human hand for even a second. We have omitted any allusion to minute mechanical details, as it is not necessary to the comprehension of the principle involved, and they only serve to facilitate the operations of the men, without in any way affecting the quality of the product of their labours.

It is impossible to imagine a greater contrast than that which exists between such arrangements as those necessary to Dr. Dauglish's process, and the system of bread-making by hand. The manufacture of aërated bread, as conducted under his patents, is one of the most perfect examples of the adaptation of mechanical means to the attainment of a required end, to be met with in the range of the arts. The great staple of existence reaches the consumer free from contamination, and in the fullest possession of all its good qualities. Were it from no other reasons than these, the application of machinery to bread-making is worthy of serious attention; but when we find that a probability exists that we can thereby materially ameliorate the condition of a hardworking and deserving body of men, Dr. Dauglish's system exerts yet another claim on our good wishes. As to the merely commercial bearing of the question, it would be perhaps premature to speak very decidedly. Hitherto, Dr. Dauglish's patents have been worked on an extended scale only by the London Aerated Bread Company. It is beyond our province to enter into strictly pecuniary details, which are devoid of general interest; we may, however, remark, that the report of the Company, recently published, shows that a profit of 12½ per cent. has been realized during the past year. The result of the declaration of such a dividend has very naturally been the setting on foot of another company, which proposes the introduction of Dr. Dauglish's system of manufacture into every town of England and Wales. The capital required is very moderate, and the n[illegible]mpany will enter into existence under very favourable circumstances, which should command success. Old Father Time perfects many things now and then by a touch of his powerful hand. The manufacture—for so it deserves to be called—of bread by machinery has not yet felt his powers. Four or five years will do much to improve that which is already very good; and we look to Dr. Dauglish's patents, in the hands of a company which possesses skill and energy, as a most important means of bringing within the reach of every man the first necessary of his existence—good and cheap bread.

FOG SIGNALS.

There are only two recognized methods of warning a ship of a dangerous proximity to rock or shoal—one is the lighthouse or beacon; the other, the fog bell or signal gun. Light or sound are the only means of informing a crew of the whereabouts of the otherwise hidden peril; and on their judicious employment depends, in a primary degree, the prosperity of our entire over-sea trade. There is something sacred about the lighthouse and its office, which renders its erection and maintenance a cosmopolitan work. Not one nation alone, but every people on the face of the whole earth, partake more or less of the gracious benefits which its light confers. Hence we find the light-keeper and his duties respected, as a rule, in all civilized warfare. Particular situations, such as the Eddystone rocks, have from time to time, taxed all the energies of the engineer, in his attempt to overcome the difficulties placed in his way by storm and flood. With his success, maritime nations rejoice; with his failure, they mourn. But even the successful establishment of a beacon which shall gleam through the night, is not all that is required. Possibly, the worst enemy the sailor has to contend with in these hard-running latter days, is fog; the all-pervading, insidious, treacherous demon of mist, found everywhere, but making the northern shores of Britain and America his special abiding place. A true fog sets even the electric light, with all its vast powers, at defiance. Thus baffled, sound comes to our aid. The bell and the signal gun have been employed to the required end, from time immemorial, with more or less success. At best, the results obtained are uncertain; and neither bell nor gun can be used with that facility and effect which is so very desirable. Our American friends, long since aware of the objections to which all known means of producing sound hitherto, had been open, inaugurated a novelty, and established a gigantic trumpet blown by compressed air, whose deep thundrous clangor can be heard far out to sea, in spite of the densest fog that ever settled down on the ocean.

It is not easy to find a point of land involving more peril to British steamers and British crews than Cape Race. Wreck after wreck has taken place at or in the immediate neighbourhood of the fatal headland. If fog ever reigns triumphant, it is here. Light fails as a means of warning, and any sound hitherto produced has very imperfectly answered the desired end. A proposal has been made frequently to erect one of Daboll's trumpets, but in vain. The Associated Press of New York offered to provide one; but either from the jealousy of our own Government, or from some other equally powerful cause, that proposition was declined, and the establishment of a fog signal at Cape Race remains under the consideration of our Board of Trade. What the ultimate result will be, we cannot say. Several proposals and schemes have been brought under the notice of the Trinity Board. The only plans which have received much consideration or approval, are those proposed respectively by Mr. T. T. Vernon Smith and Mr. Arthur S. Denny, both of whom have had considerable experience in the construction and working of fog signals—the latter having erected some fifteen in the south-western portion of the United States; and the former, the only one now in operation on British territory. The principles involved in the two inventions are, it appears, pretty nearly the same; and their combination has apparently resulted in the production of a very powerful machine—for we can call it nothing else. The invention is embodied in the use of superheated high-pressure steam, operating upon a combination of colossal steam whistles *tuned in harmony*. The precise nature of the invention, and the views of the inventors, are thus indicated in a little pamphlet recently published by them:—

"It is a theory in the science of acoustics, and experience has proved it to be true in practice, that the power of sound is greatly increased by combination (see 'Essay on Sound,' by Sir J. F. W. Herschell, Bart., F.R.S.), and that harmonious sounds may be heard much farther than discordant ones. This is a feature of the invention. Mechanical appliances of a simple character, and self-operating, regulate or interrupt the sound at certain intervals. Its mechanical arrangements are such, that not only may ordinary signals be conveyed, but messages may be transmitted. Another important feature of it is the manner in which it indicates the particular locality in which it is placed. A certain number of musical airs are familiar to seamen throughout the world. A particular strain may indicate the name of a particular point of land, and may be so described on the mariner's chart. The signal machine may perform this familiar air in the same manner as it sounds the signal, and with the same power. The mariner catching the strain many miles out at sea, and lost in a fog, may, by referring to his chart, know at once, and without any mistake, what point of land he is approaching. The machine requires no attention whatever during its operation, its action being continuous and self-operating so long as steam is kept in the boiler. The construction of it is such, that it can be disarranged only with the greatest difficulty and by design."

To add anything to the mass which has already been written, on the necessity for establishing a fog signal apparatus at Cape Race, would be superfluous. The late accident to the "Africa," speaks for itself in language before which the opinions of the entire press sink into utter insignificance. Yet the mail steamer's mishap, is one of the least of the sad catastrophes which a little money judiciously laid out would have averted. We wish Mr. Smith and Mr. Denny every success in their labours; and from the evidence laid before us, we have little doubt that they have really achieved a mechanical success; and we trust that their invention may win its way into that general adoption which it apparently deserves.

THE ORDNANCE REPORT, 1863, CONDENSED; AND CONCLUSIONS FROM IT.

No. VII.

Value of the Armstrong Gun.

In showing from the Ordnance Report what the Armstrong system is, or rather what it is not—for the evidence proves that, in the construction of the gun, there is nothing of Sir

William's invention but his abortive breech-piece—we incidentally alluded to some of its prominent defects. We did so to illustrate mistakes in the appropriation of other men's ideas and to demonstrate that, in the combinations of the projector, there was no novelty or basis of success, except the contrivances, which resulted in his obtaining an extensive command of the public money.

Resuming the analysis of the Report, we now adduce the opinions of the most important witnesses, as to the value of the system of artillery, which has cost the country so large a sum.

In our last impression, we made it apparent that Sir William Armstrong stood almost alone amongst ordnance constructors, in regarding the coil system, as the most perfect plan of strengthening guns. But, although holding that opinion, he inconsistently admits that, if homogeneous iron or mild steel could be manufactured, in large masses of uniform quality, it would be preferable to coiled hoops of wrought iron. This mode of construction, therefore, is only a temporary expedient; and it is one which other manufacturers of ordnance had either adopted as efficiently as Sir W. Armstrong, or having turned their attention to it, had rejected. These facts are undeniable, and at once dispose of this part of the system, as being of doubtful value. Here is the evidence of the witnesses, beginning with Sir William Armstrong himself. Being asked (No. 4,649): "Then what do you mean by the coil system as applicable to the barrels and the hoops?" He answered: "The gun with the barrel of steel, as exemplified in my first gun." He was next asked, "What is the system of construction, which you say the country has gained?" He replied: "The coil system; but I have made the internal tubes of the gun of both steel and coils; I use the coils as an *alternative* when steel is not to be obtained." He thus actually abandons his claim to the gratitude of the country, by admitting, in contradiction to his former evidence, that steel is preferable to coiled iron. What then is the value of this part of his system, if at any time coiled iron may be superseded by a better material? And what credit is due to him, when it has been proved, that other ordnance manufacturers used coiled iron before and simultaneously with him, as an alternative? Mr. Whitworth says (No. 1,316 and 1,317): "I do not approve of either forged iron or the coil. I have never yet made a gun with a tube of welded iron; I never would think of doing so. I prefer a mild steel or what is called homogeneous iron. Its use for the inner tubes of my gun, I consider a distinctive feature. Sir W. Armstrong, in a letter to the *Times* of November 28, 1861, says: "I was compelled for a time to make the inner tube, *contrary to my principle*, from a solid forging, instead of from coiled iron, and the result has proved the inferiority of the plan." This shows how little reliance is to be placed in Sir William Armstrong's impressions or opinions, proving, what we before stated, that the Ordnance Committee was right in regarding him as a projector of artillery, making ruinous experiments with the public money. Captain Blakely (No. 4,626): "I may say that I consider that the coil system was at that time (1859) a mere makeshift. The object of the coil system is to get welds of wrought iron round the gun, in that form in which they will be least mischievous. But it must be evident that, if we can get rid of the weld altogether, we gain an advantage. Now, ever since 1859, the greatest number of guns that I have made have been made with cast steel where we have no weld." (No. 4,638): "There is no difference whatever between my system and the Armstrong, except that I dislike the coiled iron tube. I prefer to use steel." (No. 4,640): "I think the whole of a moderately-sized gun should be made of steel." Mr. Anderson, the superintendent of the gun factory at Woolwich, an authority which Sir William Armstrong cannot repudiate, says (No. 688 to 692): "I think a solid forging or steel lining is better for the interior of the gun than the coil, though Sir William Armstrong does not agree with me on that point; if we take and forge the iron into solid lumps, and then elongate it into a tube almost 3 in. longer than the bore, and then bore out all the unsound part, the remainder is very sound, and we obtain a very good shell. With the larger guns we pile the great slabs above each other, and then elongate them so that the weld should be distributed through the mass, and so that the weld should be in the line of the gun, and that would tend to make the iron of a uniformly tough kind."

We need not add another word to prove that the boasted coil system is no equivalent for a fraction of the three millions, which it has been the chief means of extracting from the public exchequer. From the great progress already made in producing large masses of iron or steel of excellent and uniform quality, we may conclude, that the days of coiled wrought iron, for the construction of ordnance, are numbered, and that all the Armstrong guns made on that principle will, at no distant period, be thrown aside as unserviceable. There will remain the bitter reflection, that, if justice had been done to Mr. Whitworth, Captain Blakely, the Mersey Company, and others, a great portion of the enormous sums spent on the schemes of the favourite of the War-office, would have been saved, and the country would have obtained rifled guns far more serviceable than those it possesses.

In describing the Armstrong system, in the preceding parts of our summary of the Ordnance Report, we have already furnished abundant evidence to prove that, independently of the want of originality of invention in the parts of the gun, of which the combination is viewed as the Armstrong system, there is no intrinsic value in any one of them. Witnesses, whose testimony must be taken as reliable and conclusive, not only condemn the gun as a whole, but prove the radical defects of the parts separately. As to the coil principle, nobody but Sir William Armstrong adheres to it; and he confesses he does so doubtingly. The breech-loading plan, the vent-piece, the breech screw, the combined polygroove and compression system of rifling, and the lead-coated projectile, are all and each proved to be defective and objectionable, in a greater or a less degree, for the actual service of warfare. Beyond Sir William Armstrong's own evidence, and that of his partners and immediate supporters, there is not a single witness, who does not qualify any favourable opinion he has expressed, by doubts as to the efficient action of some one or other of the parts of the gun, if exposed to rough usage. We have given copious extracts from the Report to that effect. The general tendency of the objections is, that the working appliances of breech-loading and rifling, are much too weak and delicate, and too uncertain in their action, to be relied upon in the field, in batteries, or on board ship.

We might enlarge upon this subject; but the defects of the Armstrong breech-loader are so generally understood and admitted, that we think we have sufficiently fulfilled the task we undertook by proving, on the unquestionable evidence of the Ordnance Report, that that system of artillery is a complete failure. It is evident that Sir William Armstrong himself is of the same opinion. He no longer presents himself before the public as the inventor of the breech-loader. The effects of the 100-pounder, which, in magniloquent strain, used to be termed a 200-pounder, are no longer referred to. Even the *Times* is silent on the merits of this "magnificent" gun, which was, it said, unrivalled. At short range, it is proved to be inferior to the cast-iron 68-pounder in penetrative and battering power. This 100-pounder is repudiated as a naval or siege gun, except for special purposes with other guns, and is utterly condemned for service between decks or in casemated batteries. With those witnesses whose evidence is most in favour of the gun, there is but one voice, in acknowledging that, no matter for what service, the Armstrong breech-loader should be introduced in small proportions with other more serviceable artillery.

This limitation to the use of the gun is its absolute condemnation. It may be tolerated, but it must not be universally adopted; it cannot therefore be regarded as *a service gun*. We defy the most ardent advocates of the Arnstsong system, to show from the Report, that it is applicable for any but exceptional purposes. It therefore has no value as a service gun; it is not the gun the country can rely upon; it is not the gun which justifies the expenditure of three millions to produce it. Consequently, it is not to be wondered at that the Select Committee on Ordnance, with a strong desire, on their part, to deal leniently with the high officials of the War Department, could find no words to exculpate those amongst them, who were compromised by the lamentable contract with the Elswick Company, more decisive than the following: "The Committee is unprepared to impugn the wisdom of the course adopted by General Peel, and followed by succeeding Administrations, with reference to the Elswick Company"—an expression more damaging in character than "damning with faint praise." It tells the Government plainly, "we show you the conclusion we have arrived at, but we abstain from giving it utterance in words."

The 100-pounder—that beautiful piece of highly-finished mechanism, of which a specimen was intended to be one of the glories of the International Exhibition, and a defiance to foreign nations—was held up with pride by its constructor and the War Department, as the perfect type of the Armstrong system. To give it more importance, it was called a 200-pounder. If we take that gun as the standard of the system, we cannot do injustice to from its value. With reference then to that gun, the evidence we have laid before our readers, the following deductions clearly result:—

1. For smashing and penetrating effect at short ranges—those ranges at which siege operations and naval combats are decided—it is inferior to the old 68-pounder smooth-bore.

2. It cannot with safety be used in casemates or between decks.

3. It is weak at the breech end, and the vent-pieces, even with the greatest care, are liable to break and fly out.

4. The soft-coated projectiles are liable to jam in the rifling and render the gun unserviceable.

5. The working parts are so delicate, that a little rust or dirt upon them, will prevent their action.

6. The heavy vent-piece, w[illegible] [illegible]rly

2 cwts., which has to be lifted in and out in loading and unloading, is a serious hindrance to the working of the gun.

7. The 7 in. bore is the extreme limit of the calibre to which the Armstrong system could be applied. Sir William Armstrong virtually made this admission to the Committee; and, in fact, no attempt has been made, to make a larger gun on that plan.

8. Spherical projectiles cannot be fired from the gun.

These are patent facts; their truth and their force, as a complete demolition, of the Armstrong theory, are silently acknowledged by the Government, by the introduction of the Armstrong shunt to replace the Armstrong breech-loader.

The public has been lately entertained by the "graphic" description, in the *Times*, of the performance of the 13 in. Armstrong shunt gun, of which the report has the sensation heading—"Tremendous Smashing Power of the Armstrong 600-pounder."

We shall, on another occasion, show what the Armstrong shunt really is. For our present purpose, it is sufficient to point out, that the very fact of the shunt being brought forward to do the work, for which the original Armstrong gun was intended, is conclusive proof, not only that the latter is an absolute failure, but, that it is abandoned by its astute author, and its once enthusiastic patrons.

But this shunt gun is another incipient Armstrong job. Like the defunct breech-loader, it is heralded into notoriety by exaggerated statements of its power and character. It receives, as all the Armstrong guns have done, the especial attention of the Ordnance officials. It is again the favoured gun. Its defects are glossed over; every allowance is made for the difficulties of a first trial; every opportunity is afforded to remedy and conceal its short-comings. No other great gun meets with the same indulgence and consideration.

To prevent another Armstrong monopoly, into which it is evidently the intention of the Elswick Company to *shunt* the War Department, the public must look to the intervention of Parliament, which happily will soon assemble, and especially to the vigilance of the press, which, in this great national matter, will not fail to do its duty.

We cannot more appropriately terminate this notice of the Parliamentary Ordnance Report, than by giving publicity to the last paragraph of that important document, which is to the following effect: "Your Committee venture to express a hope that the different systems, not of Sir William Armstrong and Mr. Whitworth only, but of the other able men, whose minds are now engaged on ordnance questions, may be fairly experimented upon."

We trust, indeed we feel assured, that the House of Commons will do its duty by requiring the Government to carry out that recommendation of the Committee in a fair and liberal spirit, and by voting an adequate sum of money for that purpose.

SUGAR MACHINERY.*

FEW engineers know anything about sugar machinery, the construction of which has hitherto rested in the hands of a class of machinists who are extremely unwilling to impart the smallest scrap of information. A thorough acquaintance with any particular system of mechanism never comes by intuition; and even the theoretical information which can be gained from the very few books which treat of the manufacture of sugar, is of the most superficial and inaccurate kind. It is sufficiently strange that engineers and sugar bakers—to use an old technical term which no longer retains its literal meaning—should manifest such a peculiar reticence in this matter. Correctly speaking, it is hopeless for an outsider to attempt to gain admission to those mysteries which the guild are determined to keep to themselves, for no good reason that we could ever make out. The silence has been broken at last, the Eleusinian veil torn down, and the mechanical secrets of sugar-refining revealed in all their naked simplicity to the public; and this, too, by a gentleman who has apparently had an extended experience, both home and colonial, in those matters of which he treats. We doubt if a book has been published of late, which will be read with more interest than Mr. Burgh's "Treatise on Sugar Machinery." It is full of defects, both in grammar and style—diffuse where the reader wishes the author had been more concise; and concise to a fault where he might have treated his subject with advantage, at length. Notwithstanding all this, the book is a good book in the fullest sense of the term, because it answers the intended purpose as thoroughly as possible. It forms a complete text-book to what we may term an occult art; and it therefore possesses an exceptional value which cannot fail of appreciation. Details of the actual mode of construction necessary to the erection of a full-sized sugar-mill, are given with minute exactness, the letter-press being illustrated with a set of admirable plates, quite capable of being employed as working drawings. Everything described is of the latest and most improved construction; for the houses engaged in the trade, carry on a keen competition in machinery, which is certain to lead to gradual improvement in matters of detail. Charcoal-burning furnaces, purifying retorts—vacuum pans, all receive a due share of attention, to the smallest particular of nut and bolt, pin or rivet. Mr. Burgh has added rashness to his courage; and not content with risking the wrath and contumely of the "powers that be," whose secrets he throws at the feet of the public, by describing mechanism, he has actually had the hardihood to enter into a minutely detailed statement of prices and estimates, prepared as carefully as though it were actually to be worked from again, as it has probably been worked from before.

The treatise is, in fact, a collection of specifications, describing the method of constructing every portion of a large sugar factory, and stating the price at which the work can be honestly done. The character of the book precludes the possibility of making detached extracts at length; one short one, however, we will give, on the power required to drive a set of crushing rolls, as the question is one which has given rise to many a bitter controversy, and very little is really known about it, even by the initiated, from the absence of accurate experiment.

"The nominal horse-power" (calculated, we presume, as 33,000 lbs. raised 1 ft. per minute), "requisite for a sugar-mill of any given size, taking into consideration all contingent liabilities, will be deduced from the following rules:—The speed of the periphery of the rolls should be about 18 ft. to 21 ft. per minute; the speed of the piston of the engine should be 200 ft. per minute. The motion of the engine being greatly in excess of that of the mill, the latter is reduced by spur gearing in the following manner:—A pinion keyed on the crank shaft works into a large wheel, thus partially reducing the motion; on this wheel shaft a small pinion is also keyed, which works into another large wheel, thereby reducing the motion to the required speed. On this last shaft a sliding clutch is fitted, which connects to the top roll shaft of the mill when required. The surface of the rolls is the chief consideration, as from these the amount of power requisite may be deduced. It is obvious that in practice the surface of rolls of a large diameter has more friction in proportion than that of smaller rolls, for the following reasons:—When two surfaces are in contact, the nearer each is in shape to a straight line, the greater the amount of friction, owing to the surface in contact. Again, when two bodies are in contact, and a third has to pass between them, the less acute the angle of the surfaces from the point of contact, the less friction the three bodies will incur during the movement. The application of a constant number in some cases, would be impracticable. The following rule will be sufficient to enable planters and makers to produce the desiderata, taking into consideration the reduction of speed and friction:—Mills having the surface of their top roll to equal from 20 ft., superficially, require 1-horse power to every two square feet of surface; whereas, rolls with 40 ft. of surface, superficially, require 1-horse power to $1\frac{1}{2}$ square foot of surface, thus enabling intermediate proportions to be obtained."

It is very improbable that the sale of Mr. Burgh's book will be limited to one edition. As it stands at present, it only requires a little revision to render it an important adjunct to the library of the mechanical engineer. This revision, we trust, future editions will receive; and even as it is, we feel no hesitation in recommending the volume to every person who feels any interest in such matters, as the best book on the subject yet published.

* "A Treatise on Sugar Machinery." By N. P. BURGH, Engineer. London: Spon, 1863.

ON THE LOCOMOTIVE ENGINES IN THE INTERNATIONAL EXHIBITION OF 1862.*

BY D. K. CLARK.

(*Continued from page 886.*)

FOREIGN LOCOMOTIVES.—The foreign locomotives exhibited were all made for the English 4 ft. $8\frac{1}{2}$ in. gauge.

The French Department contained examples and designs of various classes of engines, some of them not known in this country. The first is an ordinary passenger engine exhibited and made by the Orleans Railway. It has outside cylinders, with the valves and valve gear outside the cylinders and crank pins. The fire-box is constructed for burning coal, with a long sloping grate, and a transverse water partition or midfeather across the fire-box, above and nearly parallel to the grate, extending backwards from the tube plate and similar in position to the fire-brick arch used in English engines, so as to deflect the flame towards the fire-door and cause it to meet the air admitted there. These are merely varieties of English practice; but the outside gearing is objectionable, for, besides being exposed to accident, the play of the parts arising from wear injuriously affects the working of the valves in regulating the distribution of the steam, to a much greater extent than when the valve gear is inside the wheels. Giffard's injector is applied, the construction being simplified by omitting the mechanism for varying the supply of water. The axles are lubricated from below by means of cotton stumps, which lift the oil by capillary attraction from a reservoir in the bottom of the axle-box.

A six-wheel-coupled goods engine for the Orleans Railway was exhibited and made by Messrs. Cail and Co. It has inside cylinders, with 5 ft. wheels and a wheel base of 11 ft. 4 in. It had already run 13,000 miles on the central division of the railway, where the curves are numerous and sharp and the inclines steep. The fore and hind axle-boxes have

* Read before the Association of Mechanical Engineers.

¼ in. play transversely, and are held taut by springs acting horizontally, which tend to restore them to their central position. The wheels are solid wrought iron, of excellent workmanship, welded at two heats on Arbel's plan. The rim is forged in segments, the nave in two circular halves, and the spokes are let into the rim segments and the two halves of the nave. The whole is clamped together, heated in a furnace, brought out and placed under a large hammer with suitable dies the size of the wheel, and welded on one side. The partially-formed wheel is again heated, and welded complete on the other side. A first-rate piece of work can be done by this process. The counterweights are welded to the rim and spokes of the wheels. The connecting and coupling rods are of cast steel.

The Northern Railway of France exhibited the "Dromadaire" heavy tank engine. The object specially aimed at in this engine was to obtain a considerable supply of steam and great tractive power, in combination with the smallest possible weight. For this purpose the fire-box is placed above the wheels and frame plates, in order to allow of greater width, a larger grate, and more tubes than when at the usual level, without lengthening the boiler. Eleven such engines are at work on the Northern Railway of France, burning coal slack. The roof of the fire-box and its shell are flat and parallel, and stayed together like the sides. The steam space in the barrel is reduced to make room for the tubes, and is supplemented by a tubular steam chamber above the boiler, containing 19 iron tubes, 3⅛ in. outside diameter and ⅛ in. thick, giving 129 square feet of drying surface; through these tubes and also round the steam chamber, the heated gases from the smoke-box pass back to the chimney for drying the steam. The chimney is laid horizontally, in continuation of the annular space which surrounds the steam chamber, since the great elevation of the boiler, nearly 8 ft. from the rails to the centre of the barrel, prevents the chimney being placed vertically with sufficient length.

This heavy-gradient locomotive has eight wheels, 3 ft. 6 in. diameter, all coupled on a base 12 ft. 6 in. long; and two cylinders, 18·9 in. diameter and 18·9 in. stroke. It has 28 square feet of grate, and a total heating surface of 1,667 square feet, having 356 tubes of 1 9-16ths in. diameter. The engine weighs in working order 42½ tons, equally distributed, giving 10 to 11 tons load on each pair of wheels.

A drawing was also exhibited of the passenger tank engines for heavy gradients working on the northern railway of France, in which the ordinary coupling of wheels is dispensed with, and four 14⅛ in. cylinders with 13⅜ in. stroke, and 5 ft. 3 in. wheels on two independent axles are employed. One pair of cylinders and wheels is placed at each end of the engine, with small intermediate carrying wheels 3 ft. 6 in. diameter, on a wheel base of 17 ft. total length.

A second drawing was shown of the four cylinder goods tank engines employed on the same railway, with six pair of wheels 3 ft. 6 in. diameter, coupled in two sets of three, each pair of cylinders working three pairs of coupled wheels: the wheel base is 19 ft. 8 in. long, and the fore and hind axle-boxes have 1¼ in. play, transversely, to admit of running round quick curves of 600 ft. radius. The cylinders are 16½ in. diameter with 17⅛ in. stroke, and the boiler contains 464 tubes 1 9-16ths in. diameter. The weight of the engine is 41 tons empty, and 57 tons full, equally distributed, giving 9 to 10 tons on each pair of wheels.

In the "Dromadaire," and the two other kinds of engine exhibited in drawings by the Northern Railway, the cylinders are outside, and the valve gearing outside them and overhung, which is, as already remarked, the most unfavourable position of gearing for continued accuracy of working. The weight of these engines is top-heavy; and for a run of 230 miles, the length of the line, they cannot well be worked with safety at the occasional high speeds demanded by a large traffic on a long line. The calculations of the capacity of the engines have been based on heating surface as such, which has been assumed to be synonymous with evaporative power. It must be remarked, however, that there is only ·44 in. clear space between the 356 tubes of the "Dromadaire," and only ·56 in. between the 464 tubes of the four-cylinder goods engine: proportions utterly inadequate to maintain an effective circulation and evaporating action on every unit of surface. There can be no doubt that half the number of tubes properly placed would have answered the purpose decidedly better. The best thing about these engines is the uniform distribution of the weight, giving great tractive power without distressing the road on the straight portions; but the wheel base is impracticably long in the four-cylinder engines, and must greatly strain the engine and road, as well as add to the resistance on sharp curves. The proportion of the tractive power, taking the effective mean pressure in the cylinders at 80 per cent. of the boiler pressure for low speeds, is about one-sixth of the weight for adhesion; which is a fair proportion and utilizes the immense weight of the engine.

The designs of an "articulated" tank locomotive of great power, like what is known in England as a bogie engine, were exhibited in the French department by Messrs. Meyer, of Vienna, one of whom is the inventor of the well-known variable expansion gear. On many railways an adhesion weight of 40 tons has now become insufficient, and the necessity for constructing railways cheaply has led to the adoption of steep gradients and quick curves; so that the engines adapted to work these lines must have in certain cases 50, 60, and even 80 tons adhesion weight, with the means of bending or fitting the engine to the curves, since the practice of using assistant engines, or separating the trains into two or more parts in particular situations, is objected to as inconvenient and costly. This engine has a single long boiler of large dimensions, mounted on two separate carriages, with a swivelling connection, each having its own separate pair of cylinders working six coupled wheels placed near together; so that the engine, although of great total length, could readily pass round very sharp curves, whilst the whole of the weight is made available for driving adhesion.

The boiler rests on the front bogie frame by a hollow ball-and-socket pivot at the centre over the middle axle, and on the back bogie frame by two hemispherical bearings on the frame, one on each side of the fire-box. The boiler thus rests on three points, whilst the two bogie frames are each free to follow the curves and irregularities of the road by swivelling under the boiler. The hemispherical bearings at the sides of the fire-box have a limited play, sliding fore and aft to suit the changing position of the boiler relatively to the hind bogie frame. The middle pair of wheels in each bogie have a considerable amount of transverse play allowed them, so as to move laterally in running round sharp curves. The two bogie frames are connected by a single strong coupling rod, having spherical bearings at each end. The whole of the cylinders, valves, and other mechanism is outside the wheels. The steam from the boiler is conveyed to the two pairs of cylinders by connecting pipes with flexible joints, and the exhaust steam from both pairs of cylinders is carried up into the smoke-box by the exhaust pipe through the centre of the hollow bogie pivot, the exhaust from the hind bogie communicating with that of the front by means of a flexible connection.

The distribution of weight on the two bogie frames is such, that the centre of gravity of each of the two portions of the load is at the centre axle. The water tanks are in front, and the coal boxes behind. The total weight of 60 tons is available for adhesion, 10 tons on each axle. Each bogie frame stands on a wheel base of 8 ft. 6 in., and the centres of the two bogies are 22 ft. apart. The wheels are 3 ft. 10 in. diameter, and the cylinders 17¼ in. in diameter, with 19½ in. stroke. The tractive power is estimated at 22,000 lbs., nearly one-sixth of the weight, so as to take a gross weight of 2,360 tons, including the engine, at 10 miles an hour on a level; and 340 tons up an incline of 1 in 40, or 155 tons up 1 in 17, at the same speed.

This plan of locomotive affords, in the writer's opinion, the most satisfactory solution yet given of the problem of obtaining a goods engine of maximum power. With independent bogie frames, each having its own separate pair of steam cylinders, a mass of coupling rods and parallel motions is got rid of, and the resistance of the engine is materially reduced in its working parts and in passing along curves, leaving an important balance of power for useful work.

In the Belgian Department is one 6-wheel coupled inside cylinder goods engine for the Belgian State Railway, made and exhibited by the Société Anonyme de Couillet. The fire-box is a reproduction of the English one previously described in the Chatham and Dover engine, with a long inclined grate, but without the longitudinal water partition. This fire-box affords the same advantage in admitting the hind axle below it, giving a moderate wheel base, in this instance 13 ft. 1 in.; and equalizing the distribution of the weight on the wheels, the loads being as follows:—

Leading wheels	... ...	11·00 tons.
Middle wheels ...	... ...	11·45 „
Trailing wheels	... ...	11·00 „
Total weight	... ...	33·45 „

The connection of the machinery and framing in this engine, is, in the writer's opinion, radically wrong. The three axles each have two outside bearings, carried by two single outside frame plates; and the cranked axle has only one additional bearing 4½ in. long, placed in the centre between the cranks. This single narrow bearing compressed between the two cranks must receive the entire fore and aft strain of the steam pressure; whilst the outside bearings more than 6 ft. apart are 7 in. long, and can receive very little of the fore and aft thrust and pull while the middle bearing is new. But, as the middle bearing must prematurely wear loose, the greater part of this strain will then be thrown upon the outer bearings 6 ft. apart; and this, acting in addition to the strain arising from the loads on the bearings outside, will be likely to break the axle. Again, the fastening of the cylinders to the frame is effected through the valve chests, which are exterior to the cylinders, in two castings spanning the space of 6 ft. between the frame plates: an arrangement which, unless the cylinder castings are made exceedingly strong and heavy, will likewise overstrain and break the connections. On the other hand, by devoting to the valve gear and eccentrics the space on the cranked axle that is usually occupied by the inside bearings, the valve motion is very conveniently accommodated; and probably this slight advantage was the inducement to depart from the usual and indispensable application of inside bearings at the wheels.

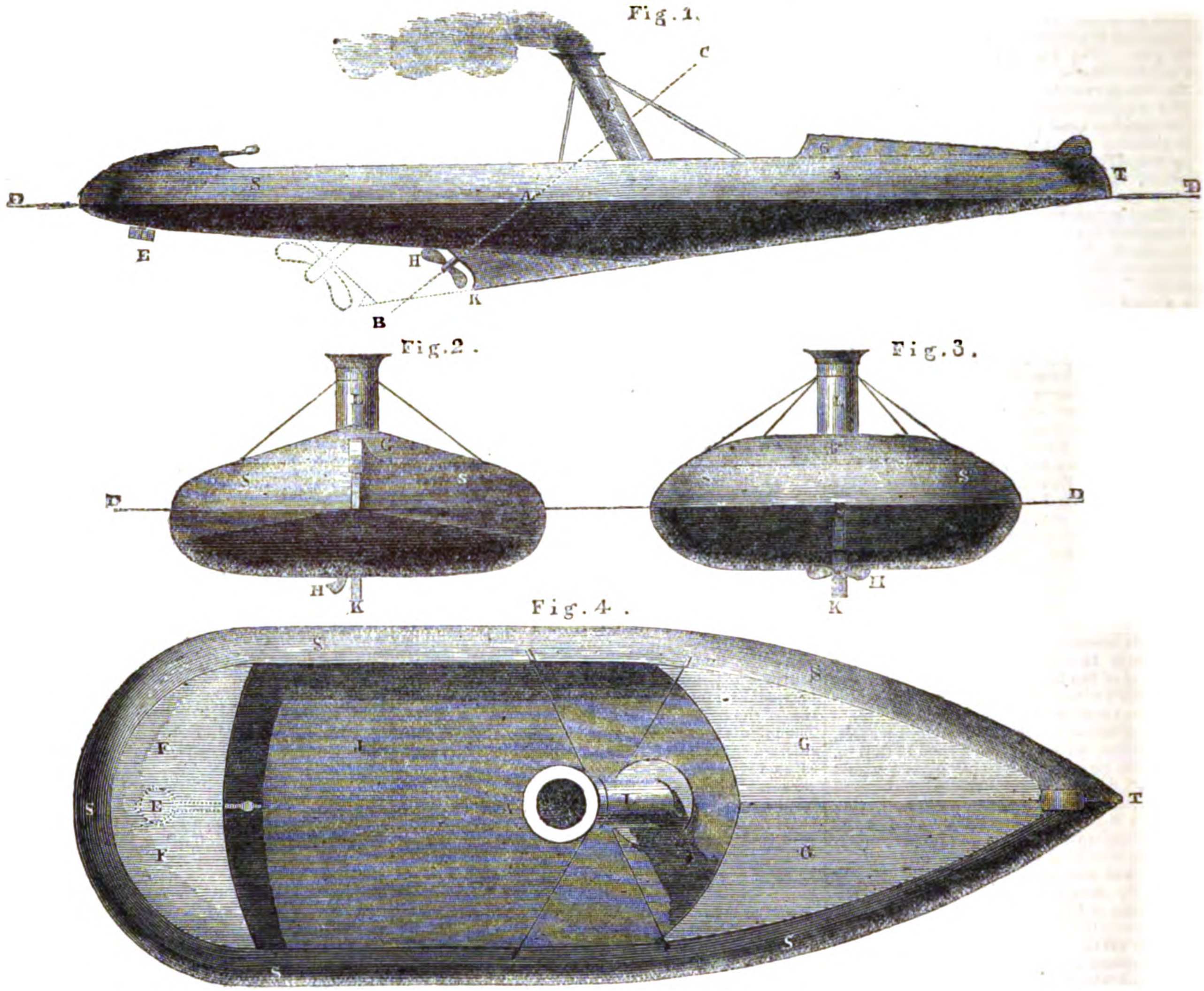
The Austrian State Railway exhibited a passenger express engine, the "Duplex," having four cylinders and four cranks on a single driving axle, specially designed for steady running at high speeds. The usual counterweights in the driving wheels are here superseded, and the reciprocating and working parts are made to balance each other by placing a pair of outside cylinders side by side, and connecting them to a crank and return crank, opposed to each other, on each side of the engine; so that the two pistons on each side and all their connections move in contrary directions and balance each other's inertia. The cylinders are 10½ in. diameter, with 24½ in. stroke, and 6 ft. 9 in. driving wheels.

There can be no question that this system is perfectly successful in effecting the object in view; and had it been brought out twenty years ago, it would, no doubt, have been highly appreciated. But, as the balancing of engines with two cylinders has for the last ten years been completely accomplished for all practical purposes by means of counterweights, the use of four cylinders as in this engine is not likely now to become popular, unless, indeed, railway companies in the race of competition should aim at excessive speeds of 80 or 100 miles an hour.

The Austrian State Railway also exhibited the "Steierdorf," a heavy tank engine with five coupled axles. The boiler rests on two frames coupled together by a pivot bolt. The steam cylinders are fixed on the front frame, and the tank on the hind frame; and the three pairs of wheels of the front frame are coupled to the two pairs of the hind frame by means of an intermediate shaft and radiating parallel motion. This intermediate shaft is ingeniously contrived to adapt itself to the varying angularity of the hind frame on curves, and at the same time to continue to transmit the power from the first to the second frame. The intermediate shaft has overhung cranks on each end, and is carried on spherical bearings by the distance pieces on the front axle of the hind frame; it is also kept at a constant distance from the hind axle of the front frame by the distance links, having spherical bearings at both ends; and the cranks of the intermediate shaft are connected to those of the axles by the coupling rods, all of which have spherical bearings at both ends. The relative positions of the three axles being thus fixed, the power is transmitted from the hind or driving axle of the front frame, through the coupling rods, to the cranks on the intermediate shaft, thence by the coupling rods to the outside cranks on the front axle of the hind frame, and further by coupling rods to the hindmost axle. The wheels are 3 ft. 3½ in. diameter, the cylinders 18½ in. diameter with 24⅞ in. stroke, and the total weight in working order is 46 tons. The fire-box, made for burning coke, has 15 square feet of grate; and the boiler contains 158 tubes 2 1-16th in. diameter, with ·69 in. clear space between them.

In the Prussian Department one engine was exhibited by Mr. A. Borsig, of Berlin. It was a six-wheel four-coupled engine, with outside cylind[illegible] 7 in. diameter by 22 in. stroke, and driving whe[illegible] of 4 ft. 6 in. diameter, the hind wheels being coup[illegible]

GILES'S OCEAN BLOCKADE RUNNER



and all the axles being between the fire-box and smoke-box. This type of engine is exclusively employed on the Minden and Cologne Railway for mixed and goods trains; and also on many other German railways. The free use of steel in the construction of this engine confers on it an air of lightness, perhaps too great lightness, which contrasts strongly with the heaviness of the tender.

The proportions of the boiler are good; and this circumstance, in addition the very excellent and well finished work, may account for the popularity of that class of engine; but it has some grave defects, which must detract from its usefulness. The suspended weight is carried on three points, by a cross spring over the leading axle and compensating or equalizing levers connecting the springs of the two driving axles on each side of the engine. This notion of a triangular elastic bearing with the apex in front, much thought of at one time, is now nearly discarded in England, on account of its giving the engine a dangerous freedom of movement at high speeds.

The cylinders are fitted with double valves for variable expansion, the expansion valve being on the back of the other, with a central passage for steam through it: the lower or leading valve is worked by a link motion in the usual manner; and the upper valve by a separate rod from the fore eccentric working in a grooved sector, from which a variable travel and cut-off are communicated to the valve. The steam port opens for the exhaust at 90 per cent. of the stroke for all degrees of expansion, and is only opened ⅜ in. for the exhaust when the piston arrives at the end of the stroke; and as the steam ports are very small in area, each being only 1-20th the area of the piston, there can be no doubt the back pressure is very considerable in consequence, and more particularly with an outside cooling cylinder. For a 17¼ in. outside cylinder in the Caledonian engine previously described the area of steam port provided is 1-11th that of the piston, whilst the valve is open full port for the exhaust when the piston reaches the end of the stroke. Moreover, it is not good practice to keep the same point of the stroke for the exhaust under all degrees of expansion; high expansive working usually accompanies high speeds, and therefore the exhaust should be made to open earlier in the course of the stroke for the higher grades of cut-off, in order to give the steam greater liberty for escape before the piston returns upon it. These conditions of the good working of steam are comprehended in Stephenson's expansion link motion, and are now thoroughly appreciated and established in English practice; and the other attempts at expansive valve motion for locomotives have been abandoned in this country.

In employing steel for the working parts of this engine, such as the piston rods, the connecting and coupling rods, and the crank pins, the dimensions of the wearing surfaces have in some cases been reduced. The bearings of the coupling rods are reduced in proportion to the size of the rods; though it is reasonable that as the strains remain the same the sizes of the wearing surfaces should not be altered. The axle-boxes are of wrought iron.

In the Saxon Department a six-wheel four-coupled engine was exhibited by Mr. R. Hartmann of Chemnitz, specially designed to work in mountainous districts. It is, in fact, a bogie engine, having four coupled wheels 4 ft. 6 in. diameter with 21 tons on them for adhesion, and a swivelling truck on Bissell's plan in front with 7 tons load, making a total of 28 tons. The cylinders are 15 in. diameter by 22 in. stroke; and are outside, with outside valve gearing, as is so prevalent a custom on the Continent. The framing has two longitudinal plates 8 in. deep and 1⅜ in. thick, to which the cylinders are fixed, with 16 in. of overhang. This is an excessive overhang upon so narrow a frame plate, and the valve gear being still further overhung the valve hops about at every stroke as the axle-boxes wear. Overhung eccentrics for valve gear outside the crank pin never do well for heavy work in consequence of the unsteadiness. The best feature in this engine is the swivelling truck with a triangular frame, which carries the fore part of the engine on one pair of wheels with a limited but sufficient allowance of lateral play, and radiates on a pivot behind it fixed under the boiler. With a flexible wheel base only 11 ft. 9 in. long there is no doubt that in this engine and in others of ordinary size the Bissell truck is well adapted for leading round the quickest curves likely to be found in practice.

In the Italian Department an inside cylinder six-wheel-coupled locomotive is exhibited from the Pietrarsa Royal works, Naples, which is a creditable specimen of the old school of locomotive.

AN OCEAN BLOCKADE RUNNER.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Will you permit me to call the attention of the public to the advantages of a novel steam ship of my invention, through the medium of your valuable paper.

The ocean offers advantages for the attainment of a high rate of speed in locomotion superior even to the land; one of the foremost of which is its greater safety, there is no fear of getting off the rails; and the area of locomotion not being so limited or so intricate, the chances of collision, under

judicious management, are less. The requirements of society in their social as well as political aspect, now also need a more active and energetic system of intercommercial and international communication, for the purpose not only of securing an efficient distribution of the necessities and conveniences of life, but also to counteract within healthy limits the ever too great tendency of governmental interests to impede the channels of traffic and trade. We now see large territories possessing plentiful supplies of those commodities which the manufacturing interests of Europe stand particularly in need of, blockaded by either French, American, or English war vessels; and from the fact that European Governments are now in possession of all the fruits of past mechanical invention and enterprise, and are rapidly constructing everywhere large fleets of vessels especially intended for war (which means for the destruction, suppression, or controlling of commercial enterprise), it is all the more necessary that the productive and progressive interests of society should investigate still further the principles of mechanical science, and provide themselves with agencies for evading or counteracting a too complete control of their operations. As civilization has extended its influence over new territories and widened the area of its settlement, it has been accompanied by a corresponding development in mechanical science. America (at the period of its settlement considered a distant country) has by the aid of steam power and other mechanical appliances been brought into close relationship, both socially and commercially, with Europe. This mechanical system has also, under the influence of industrial and commercial enterprise, effected settlements in the distant territories of the southern hemisphere, and the first links of social and commercial sympathy between Europe and Australia, Japan and China, have been already constructed. To contribute to the growth and maturity of these relationships, it is necessary to solidify the interests of commerce and trade by more energetic, constant, and rapid communication, and then these vast territories will present multiplied repetitions of that commercial development and social progress which has existed hitherto almost exclusively with the American continent.

The discovery of the principle of *traction by gravity* or *oblique propulsion*, which is an expression of the mechanical power employed so as to bring into horizontal co-operation the latent force of *gravity*, opens up a great advance in efficient and economical effect both in land and water propulsion, and offers to the mechanical and commercial interests of the world, the means for accomplishing an immense stride, both in stimulating the development of their agricultural resources, and the more active and economical distribution of merchandise exclusively by steam power. This mechanical principle, which is the same as that employed in the construction of "Giles' Bull," is illustrated in its application to water propulsion in the engravings on the preceding page.

In water propulsion there are two chief points to be considered—the one is *resistance to the vessel*, the other *resistance to the screw*. The first, or resistance to progress, should be as small as possible; the second, or resistance to propulsion, as great as possible. The mechanical properties of water offer very great facilities in the construction of the vessel for effecting these ends, because, although water is not an elastic liquid, and therefore does not increase in density by depth, yet depth increases its solidity, and at 30 ft. below surface, it needs fourteen times the power to displace a given area than at the surface. The mechanical properties of water are like that of a pile of bricks; there is the same density of substance in a brick taken from the top as from the bottom of the pile, but the upper tier could be removed by a force which would make no impression on the lower tier. The obstacles hitherto to the efficiency of the screw have been want of immersion, and when that has been attained, the increased resistance to the vessel's progress in consequence of her increased draught of water. The two chief conditions of rapid ocean traffic are therefore *lightness of draught for the vessel*, and *depth of immersion for the screw*. Both these objects are attained by the above mode of construction; and in addition to the fact that there is no sacrifice of propelling power from its oblique application, because another (otherwise latent) force, *gravity*, is brought into horizontal co-operation (*without friction*); so also there is a great mechanical economy effected by expressing the propelling force downward, it being across the current made by the vessel's progress. By this method, vessels of light displacement can be fitted with screws of almost any power, by extending the keel aft, according to the dotted lines in fig 1, and prolonging at the same time the stern of the vessel, so as to bring the centre of gravity over the screw. The vessel tapering off at each extremity, and having no keel except amidships, secures also the easiest possible steering, and the most ready reply to the least motion of *the helm*.

Fig. 1 represents the side view; fig. 2, the bow; fig. 3, the stern; fig. 4, the deck. The keel starts out from the bilge or deepest part of the vessel extending aft and downward in a line from the bow, and the screw shaft is placed at an angle of, say, 30 to 40 deg. with the horizon, the thrust of the shaft being taken at or near the vessel's centre of gravity, A. A speed of 30 to 40 miles per hour, in fair weather, is attainable by this method.

The best guarantee for the interests of commerce against any abuse of power by the vast fleets of ironsided coffins now being constructed by the Governments of Europe, is *a light pair of heels*.

JOHN GILES.

London, December, 1863.

THE WATER MILLS OF ARGOSTOLI.

A CURIOUS natural phenomenon occurs, and is taken advantage of, in the neighbourhood of Argostoli. At four points on the coast, the sea, at its ordinary level, enters a very narrow creek, or broken rocky channel, and after running somewhat rapidly through this channel and among broken fragments of rock for a short distance, it gradually becomes sucked into the earth and disappears. By conducting the water through an artificial canal for a few yards, and so regulating its course and forcing all the water that enters to pass in a single stream beneath an undershot wheel, power enough is obtained in two cases to drive a mill. Mills have, in fact, been placed there by an enterprising Englishman, and are constantly at work. The stream after being utilized, is allowed to take to its natural channel, and is lost among the rocks.

It is common enough to drive a wheel by a current of water going from the land towards the sea; but it is certainly rare, and, as far as I am aware, peculiar to the locality, to find mills driven by a current of sea water, acting quite independently of tide, the water constantly and steadily rushing in over the earth's surface and finally disappearing. It is not the river god pursuing the nymph, but the great Neptune himself invading the domain. No wonder the Cephalonians are proud of their mystery; and it will be interesting to consider the circumstances attending it.

Apart from the facts that the water sucked into the earth is sea water, and that it enters below the sea level, there is nothing extraordinary or unusual; for numerous instances occur in every limestone country of streams, often of very considerable dimensions, entering into open fissures and disappearing. In England there are two or three cases of this kind; and in the Ionian Islands absorption of water into the earth is so rapid, that there is hardly an instance of any appreciable quantity of the rain-fall being retained long enough on the surface to form streams and carry off the water to the sea. Almost all the rain is there absorbed, and this is certainly the result of the cracked and broken nature of the limestone rock—of the numerous natural caverns penetrating every part—of the constant enlargement of fissures into caverns in one place, and the choking up of caverns by stalagmite and stalactite in another—and of the especially fissured and cavernous nature of certain kinds of limestone, of which the rocks found in the Ionian Islands and Greece afford notable examples.

But it is certainly very seldom that we are able to satisfy ourselves of the empty state of the limestone caverns close to the sea and below the sea level, as we can at Argostoli; and for this reason, if for no other, the phenomena are worthy of particular notice.

The general condition of the surface is as follows:—The small harbour of Argostoli is enclosed on both sides by the hard, broken, limestone rock so common in the islands. On the east side it rises immediately into hills of moderate elevation; and on the west side, behind the town, there is a plateau, scarcely above the usual level of the water, rising about two or three hundred yards from the shore into a low ridge, which, in fact, by its projection into the gulf makes the harbour. Between the shore line and this low ridge there is an evident depression of the surface in all that part over which the sea when it enters is sucked in. There is evidently beneath this part an extensive cavernous tract, which may well hold much more water than during any ordinary season or succession of seasons can drain naturally into it in consequence of the rainfall at the surface.

But what, it will be asked, becomes of the waters of the sea thus pouring in continually to fill the cavern? Certainly, in time, any cavity must be filled, if it has no natural outlet, and if water is constantly entering it. How, also can the water run off, if its level in the cavern is below the sea level? It is not, perhaps, so difficult as may be thought to answer these queries.

The water that everywhere enters the earth is always circulating. It not only pours down into and amongst all rocks, but is afterwards lifted, and the level of these subterraneous stores is greatly elevated by operations going on at the surface, often at a great distance above.

The cause of this is evaporation, which proceeds incessantly from the surface of all rocks, but especially from limestones. The narrow crevices, common in limestone rocks, act as capillary tubes. When water falls on the surface of such rock, it finds its way down readily, and this seems quite natural; but when, in hot countries, where there is a long summer season of great drought, the surface becomes dry and hot, moisture rises in steam from below; and, as the heat and dryness increase, the accumulated waters become more and more exhausted. All this goes on without reference to the actual level of the water line within the earth, which may be far beneath the level of the sea.

That this is the case in the softer limestone rocks, even when not cracked, has been proved by actual experiment. That it takes place to an enormous extent in the limestones of the eastern Mediterranean is proved, if in no other way, by the fact that vines, planted among bare stones, without soil, obtain an ample supply of moisture from the earth, and ripen their fruit to perfection in the hottest and driest seasons. No doubt the earth and rocks are hot, and appear dry; but so long as there remains any water below that has passed down during the rainy season, so long will a part of that water be given back to the dry and thirsty soil above.

If then, as is probably the case, there is so large an evaporation from the part of the surface of the Island of Cephalonia, within range of this district, as to keep the water level of the year below the sea level, in spite of the joint supply of rain and sea water, it is clear that the water may run in for ever at the same rate without filling up the space. And this I believe to be the correct explanation of the phenomenon.

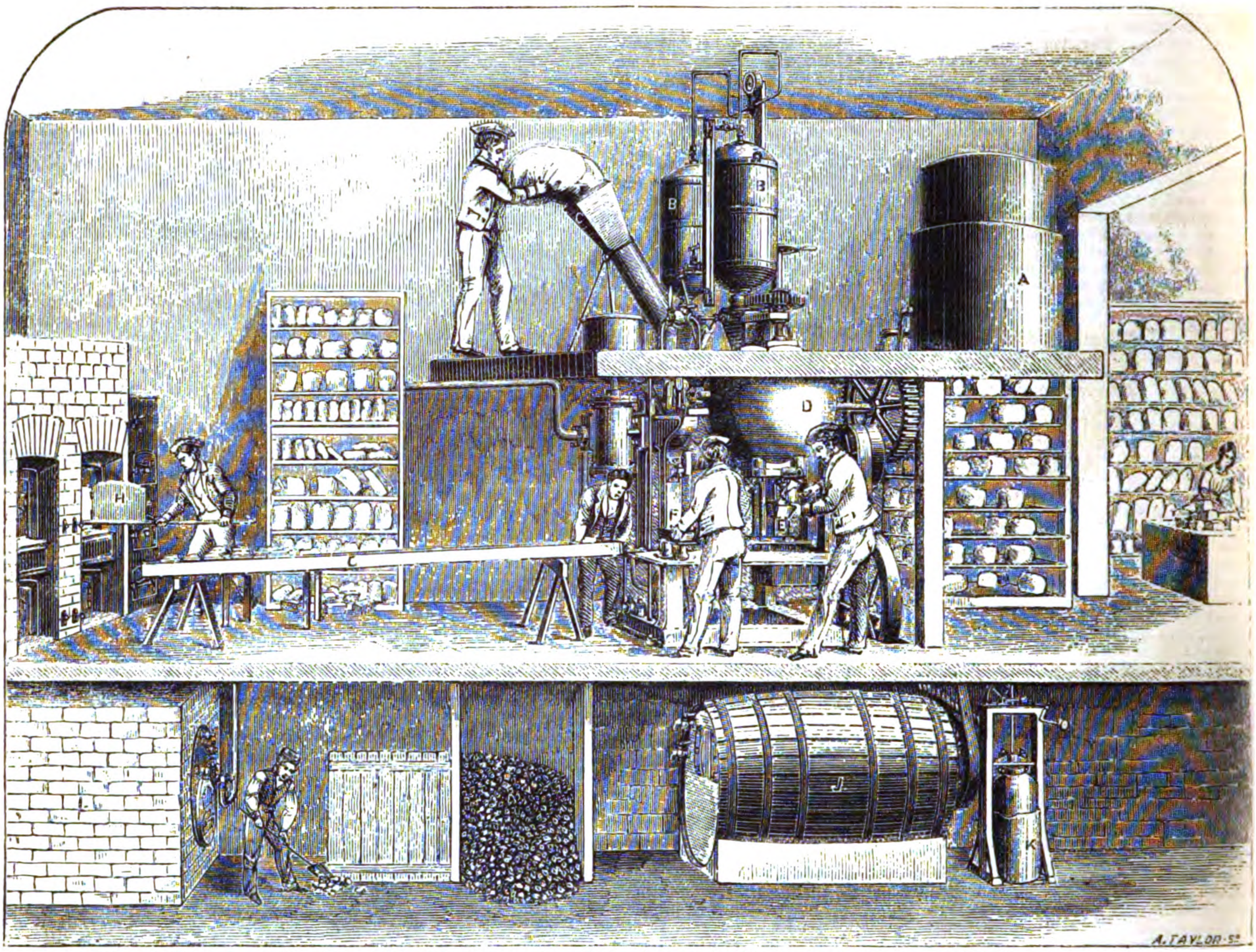
The influx of water, however, is not small. It amounts, as far as I could make out, to more than half-a-million of gallons per diem, for the two mills together. The fall of water from the sea level into the cavities, where it disappears, seems to be little more than a foot or eighteen inches.

There appears to be something like a lunar tide in the harbour and gulf of Argostoli, the water entering and flowing out twice a day, and the level of the water varying about 6 in. in ordinary weather, and when there are no disturbing influences. Any wind blowing steadily for some time, and all storms, whether at a moderate distance or near, affect the water level in a marked degree, and complicate the apparent tide. In one of the cavities where the water disappears from the surface, the level of the surface of the water below may always be reached, and it is said to rise and fall with that of the sea, even when the influx of the water is stopped. This is quite possible, without assuming a free communication, which would of course at once fill the cavern to the sea level.

There is a constant tendency to choke up the crevices through which the water disappears, by a seaweed very common on this coast. This and the silt would probably soon interfere greatly with the current that enters the crevices, if the channel were not kept artificially clear. The water, however, is greedily and rapidly absorbed by the whole surface of broken ground near the sea, between the two mills.

It will be evident that if the sea water finds its way into any large natural cavity from which it is afterwards evaporated, a deposit of salt must be taking place in this cavity, or in rocks adjacent or connected with it. Assuming the influx to be at the rate already mentioned, this may be estimated roughly at about equivalent to an area of 10 acres or 12 acres of solid matter, 1 ft. thick, accumulated each year. It is an interesting question to consider where this deposit is going on, and whether saline springs may not thus be fed. Th[illegible] no known

DR. DAUGLISH'S AERATED BREAD-MAKING MACHINERY.—*See page* 893.



A, gasometer; B, B, vessels which contain aerated water under pressure; C, flour shoot to mixer D; E, dough tap; F, vessel within which the carbonic acid gas is generated by the action of sulphuric acid on chalk; G, railway along which the loaves are pushed to the oven H.

springs in the Island of Cephalonia that present any large quantity of saline matter.

Note.—Not having the means of accurate measurement, and not being able to learn that the quantity of water entering the land has ever even been estimated by the mill owners, I can only give these quantities as rough approximations to the truth.—*Ansted's "Ionian Islands in* 1863."

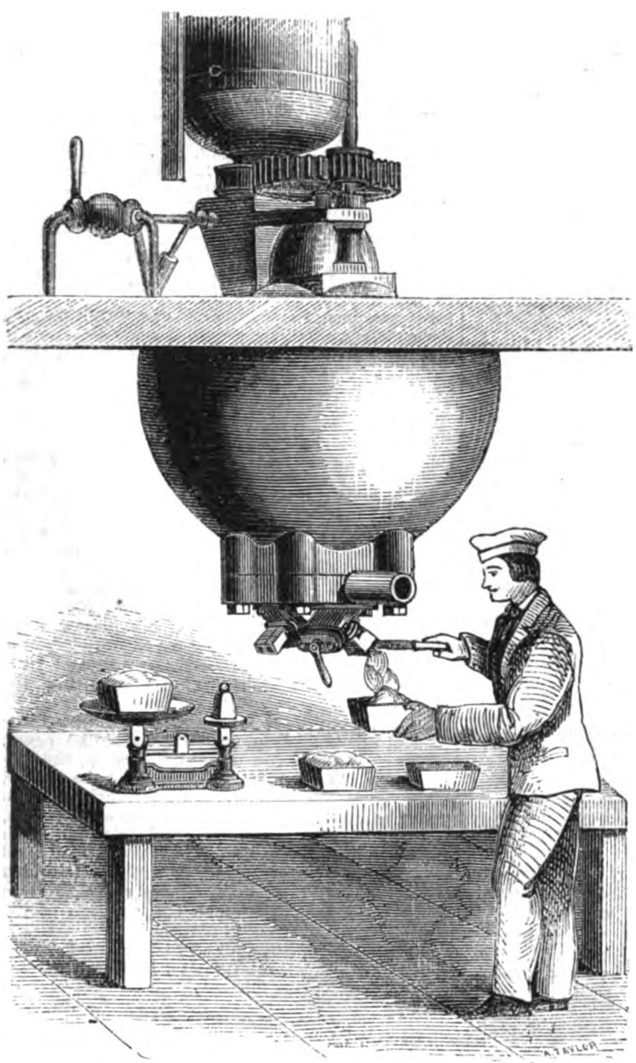
INSTITUTION OF CIVIL ENGINEERS.

THE annual general meeting of the Institution of Civil Engineers was held on Tuesday, December 15—John Hawkshaw, Esq., President, in the chair.

The report stated, that in the interval that had elapsed since the last annual general meeting, it was gratifying to the Council to be able to state that the progress of the Institution had been eminently satisfactory. The Papers read at the meetings had been numerous and varied; the meetings themselves had been very fully attended; the library had received considerable accessions, both by donations and purchases; the number of members had steadily increased; and the funds were in a prosperous condition. These were certain tests that the Institution continued to be appreciated by those in whose interest it was established, and led to the conclusion that, so long as its affairs were conducted as they hitherto had been, similar support and countenance would be extended to it. An enumeration of the Papers read and discussed at the ordinary general meetings showed the variety of subjects which engaged the attention of engineers at the present day, and the extended area embraced within the operations of the members of the profession. Many of the Papers read during the last two Sessions had, at the request of the authors, been issued already in a separate form, so that the volumes xxi. and xxii. of the Minutes of Proceedings, for the Sessions 1861-62 and 1862-63 might be said to be completed, and would be issued in the course of a few weeks. An index of the series from vol. i. to vol. xx. inclusive was in hand, and though a task involving considerable labour, had already advanced fully one half. Numerous applications having been received from the members for complete sets of the Minutes of Proceedings, the Council had determined to reprint some of the earlier numbers which were out of print, in order to be enabled to supply this evident want. The tabular statement of the transfers, elections, deceases, and resignations, showed that the number of elections had been 74, of deceases 26, of resignations 5, and of erasures 3, leaving an effective increase of 40, and making the total number of members of all classes on the books on the 30th of November last 1,040. This was an increase of nearly 39 per cent. in the last ten years, of which 4 per cent. occurred in the past session. During the last ten years the number of Members had increased to a greater extent than the Associates; for, whereas the numbers of those classes on the 30th of November, 1853, were 259 and 441 respectively, or in the proportion of 1 to 1·7, on the 30th of November last these numbers were 425 and 588, or as 1 to 1·4.

The deceases during the past year had been:—John Singleton Copley (Lord Lyndhurst) and William Tooke, Honorary Members; Thomas Evans Blackwell, William Clegram, Richard Carden Despard, James Fenton, Joshua Field, Joseph Glynn, Mark Jones, William Lewin, and Captain William Scarth Moorsom, Members; Beriah Botfield, M.P., Alexander Bremner, Alexander Brodie Cochrane, William Coulthard, William Cubitt, M.P., William Dunlop, Charles Michael Jopling, Francis Morton, Geddie Pearse, Apsley Pellatt, William Rigby, Charles William Scott, James Sherriffs, Admiral Washington, and William Richard Whitmore, Associates. It would be observed, with deep regret, that while the Institution had lost many useful and able members, there was included in the list one whose memory must ever be regarded with the liveliest interest; for to Mr. Joshua Field, to whom allusion was made, was due, in no small degree, the existence of the Institution of Civil Engineers. It was about the year 1816 that Mr. Henry Robinson Palmer, who was then articled to Mr. Bryan Donkin, first suggested to Mr. Field the idea of forming a society of young engineers, for their mutual improvement in mechanical and engineering science; and it was no doubt owing to Mr. Field's influence that Mr. William Nicholson Maudslay became the third who associated in this cause. These were shortly joined by five others—Mr. James Jones, Mr. Charles Collinge, Mr. James Ashwell, Mr. Thomas Maudslay, and Mr. John T. Lethbridge; and when the Institution was constituted on the 2nd of January, 1818, it comprised just these eight members, and so remained until the following year, when the num-

DR. DAUGLISH'S BREAD-MAKING MACHINERY.—*See page 893.*



Filling bread tins from the dough tap.

NEW SPECTROSCOPE.

FIG. 1.

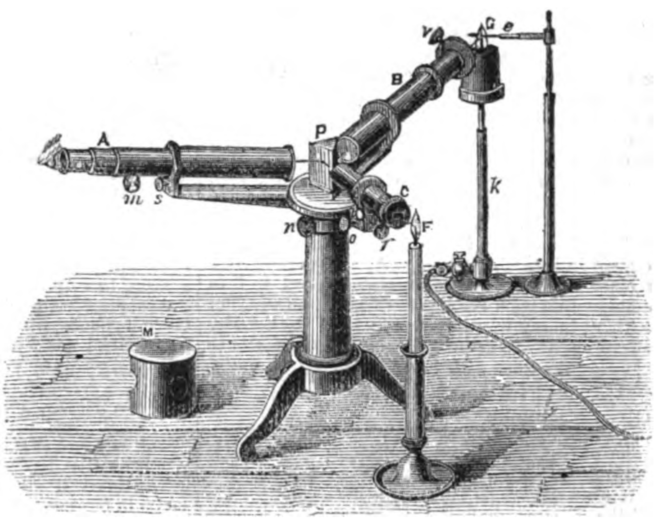
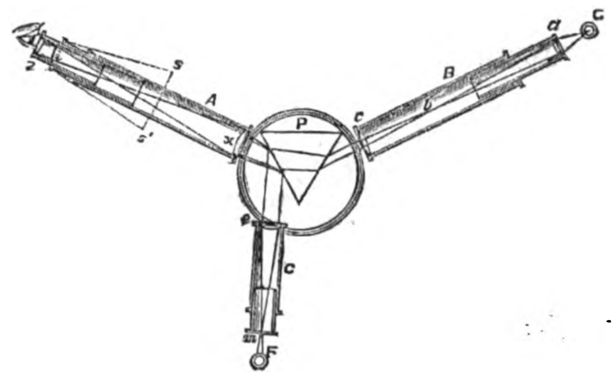


FIG. 2.



ber was increased by three. From that time to the present the numbers had steadily increased, the first great impetus being the acceptance of the office of President, in 1820, by Telford, under whose fostering hand the Institution grew rapidly in importance, and eventually acquired a permanent position among the scientific societies of the metropolis.

The abstract of receipts and expenditure, as prepared by the auditors, showed that the income from all sources, during the twelve months from the 1st December, 1862, to the 30th November, 1863, was £3,974 17s. 1d., while the payments in the same period only amounted to £2,740 8s. 11d., leaving a balance of £1,234 8s. 2d. Of this, a sum of £1,000 had been invested in the purchase of London and North-Western Railway Four per Cent. Debenture Stock, making a total of investments during the last five years out of the general funds of £3,500. The realised property of the Institution now comprised:—1, General Funds, £9,357 0s. 8d.; 2, Building Fund, £1,322 2s. 11d.; and 3, Trust Fund, £9,970 12s. 7d., making a total of £20,649 16s. 2d., as against £19,041 12s. 1d., at the same period last year.

After the reading of the report, Telford Medals and Telford Premiums of Books were presented to Messrs. J. Brunton, J. R. Mosse, Z. Colburn, and H. Hayter; Telford Premiums of Books, to Messrs. W. M. Peniston, W. H. Preece, A. W. Makinson, D. Miller, R. Crawford, W. Cudworth, and J. G. Fraser; and a Watt Medal and the Manby Premium, in Books, to Mr. J. Fernie.

The thanks of the Institution were unanimously voted to the President, for his attention to the duties of his office; to the Vice-Presidents and other Members and Associates of Council, for their co-operation with the President, and their constant attendance at the meetings; to Mr. Charles Manby, Honorary Secretary, and to Mr. James Forrest, Secretary, for the manner in which they had performed the duties of their offices; as also to the Auditors of the Accounts and to the Scrutineers of the Ballot, for their services.

The following gentlemen were elected to fill the several offices on the Council for the ensuing year:—John R. M'Clean, President; J. Fowler, C. H. Gregory, T. Hawksley, and J. S. Russell, Vice-Presidents; Sir William Armstrong, W. H. Barlow, N. Beardmore, J. Cubitt, T. E. Harrison, G. W. Hemans, J. Murray, G. R. Stephenson, C. Vignoles, and J. Whitworth, Members; and Colonel Jervois, C.B., R.E., and Mr. C. Waring, Associates.

The meeting was then adjourned until Tuesday, January 12, 1864, when the Monthly Ballot for Members would take place, and the following Paper would be read:—"On the Closing of Reclamation Banks," by Mr. J. M. Heppel, M. Inst. C.E.

NEW SPECTROSCOPE.

A MODIFICATION of the spectroscope has been recently introduced in Paris, and already attracts a great deal of attention in the scientific world. We are indebted to our able contemporary, *Les Mondes*, for the accompanying engravings of this instrument. It consists of three small tubes fitted with lenses, mounted on a single pedestal or stand, common to them all, and converging towards the faces of a flint prism, as shown in fig. 1. The telescope A can be moved at pleasure round the prism, the clamping screw *n* serving to fix it in any given position. The milled-headed screw *m* serves to adjust the focus, and that marked *s* the angle of inclination of the instrument.

In order to understand the uses of the tubes B, C, we must refer to fig. 2, which represents the changes in direction undergone by the rays of light which pass through the apparatus. The rays emitted by the flame G pass through the lens *a*, which causes them to converge at the point *b*, the focus of a second lens *c*; consequently, a pencil of parallel rays quit the telescope B and enter the prism P, where the light is decomposed, the bands of colour being rendered visible by the lens *x* and the eye glass *s*, which give apparently at *s*, *s*, a correct picture of the spectrum magnified eight times lineally.

The instrument C serves to measure the relative distances of the lines of the spectrum.

In order to do this, its anterior extremity is fitted with a peculiar glass scale, micrometrically divided into 250 equal parts. In order to prepare this scale, a paper riband is provided in the first instance, on which is carefully engraved a scale 250 millimetres long, graduated by tens. From this a negative copy is taken on glass, reduced in length, from 250 to 15 millimetres. The black lines on the original paper riband are reproduced in white on the glass scale, which is adjusted in the extremity of the tube C exactly in the focus of the lens c. This lens projects a pencil of parallel rays on the central prism, proceeding from the flame of a lamp or candle at F. These rays being subsequently reflected from the inclined face of the flint, are conveyed into the telescope A, where they give a clear image of the glass slide placed in C in combination with the image of the spectrum, but without in any way interfering with it, thereby affording a means of measuring the distance between the lines with great precision.

THE TENDERS FOR THE THAMES EMBANKMENT.

THE Metropolitan Board of Works received the following tenders on Friday, for the second portion of the Thames Embankment—namely, that part from Waterloo-bridge to the eastern end of the Inner Temple. The tenders were fourteen in number, as follows:—Mr. George Furness, £241,500; Mr. Thomas Pearson, £264,000; Messrs. Hickersley and Baylis, £257,000; W. Webster and Co., £240,000; Messrs. A. W. Ritson and Co., £229,000; Mr. T. Dockra, £260,000; Mr. J. Diggle, £229,400; Messrs. Rogers, Doon, and Co., £238,500; Mr. W. Dettrick, £232,353; Mr. W. Tatam, £264,000; Messrs. W. M'Cormack and Co., £240,656; Messrs. T. Brassey and Co., £238,500; W. Moxon and Co., £243,195; and Mr. W. Lavers, £239,800.

The Board resolved itself into a committee to consider the tenders, and when the sitting was resumed, a report was brought up by Mr. D'Iffanger, recommending that the tender of Mr. Ritson should be accepted, subject to the usual inquiries. This was seconded by Mr. Legge, and carried *nem. con.*

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

AARON SMITH.—The invention you speak of is, we believe, the subject of a French patent. What the mode of manipulation on which the success of the process apparently depends may be, we cannot inform you. Hoofs may be dissolved by long boiling in water, slightly acidulated with muriatic acid, or in a Papin's digester, or in dilute muriatic acid.

PRESSURE.—Why not? Dr. Alban once worked an engine with steam of a pressure of 1,000 lbs. per square inch in London.

TRACTION (Woking).—The pitch chain is incomparably the best. It is very difficult to employ springs and gearing in combination.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I shall feel much obliged if you, or any of your correspondents, can give me in your next journal answers to the following questions, viz.:—

(1.) What is the thickness of metal of an 11 in. Dahlgren gun at the breech, trunnions, muzzle, and behind the bore?

(2.) What length of bore of an 8 in. gun does a 16 lbs. charge occupy?

(3.) How many degrees of elevation, depression, and lateral range can be given to a 68-pounder when used at the port holes of the "Warrior"?

I am, your obedient servant,

A. F.

Glasgow, Dec. 21, 1863.

Correspondence.

STRENGTH OF METAL, BEAMS, GIRDERS, AND BOILERS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In my letter under the heading "Stress upon Boilers and Boiler Plates," published in the MECHANICS' MAGAZINE November 20, 1863, it is stated in the last paragraph of that letter, p. 808, that, "in mixing metals, if the tension *plus* the compression of the metal, both within the elastic limits, be a given quantity, that metal will be the strongest possible in which the strength in tension is equal to the strength in compression, the neutral axis being in that case at the middle of the depth which," it is there stated, "is the best position of the neutral axis, if the metal, as in the weight upon a beam, be subject to one strain only."

As the subject is of considerable practical importance, I submit, with your permission, the following demonstration of the proposition:—

Let b = breadth, D = depth, of a rectangular metal beam or joist.

t = tension, c = compression of the metal, both within the elastic limits.

d' = depth of the metal in tension.

D — d' = depth of the metal in compression.

The tension, multiplied by the depth of the metal in tension, = the compression, multiplied by the depth of the metal in compression;

$$\text{or, } t\,d' = c\,(D - d') \qquad (1)$$

$$\text{hence, } d' = \frac{c\,D}{t + c} \qquad (2)$$

In rectangular beams, $l = 1$.

$$\text{Strength} = \tfrac{1}{3}\,b\,D\,t\,d' = \frac{\tfrac{1}{3}\,b\,D^2\,t\,c}{t + c} \qquad (3)$$

By the Proposition we have,

$$t + c = \text{a given quantity} = a \qquad (4)$$

$$\frac{\tfrac{1}{3}\,b\,D^2\,t\,c}{t + c} = \text{a maximum.}$$

Differentiating with respect to t and c,

From (4), $d\,t + d\,c = 0$

$$\text{,, (5), } \frac{\tfrac{1}{3}\,b\,D^2}{(t + c)^2}\left\{(tdc + cdt)(t + c) - (dt + dc)\,tc\right\} = 0$$

Dividing, and substituting — dt for dc, we have,

$$-t^2dt + ct\,dt - ct\,dt + c^2dt - ct\,dt + ct\,dt = 0 \ldots (5)$$

$$\text{hence } -t^2dt + c^2dt = 0$$

$$\text{and } \quad t = c \qquad (6)$$

EXAMPLE.

1.—$b = 4''$; $D = 12''$; $t = c = 1$; $t + c = 2$.

$$\text{By (2), } d' = \frac{c\,D}{t + c} = \frac{1 \times 12}{2} = 6.$$

$$\text{,, (3), Strength} = \tfrac{1}{3}\,b\,D\,t\,d' = \tfrac{1}{3} \times 4 \times 12 \times 1 \times 6 = 96.$$

2.—$b = 4''$; $D = 12''$; $t = 1{\cdot}1$; $c = {\cdot}9$; $t + c = 2$.

$$\text{By (3), Strength} = \frac{b\,D^2\,t\,c}{3\,(t + c)} = \frac{4 \times 12 \times 12 \times 1.1 \times {\cdot}9}{3 \times 2} = 95{\cdot}04.$$

If $t = {\cdot}9$, and $c = 1{\cdot}1$, the result is manifestly the same—95·04.

By equation (3), the strength varies as $\frac{t\,c}{t + c}$, and, $t + c$ being a given quantity, or of a given length, the strength varies as the rectangle $t \times c$, which, as known, is a maximum when $t = c$, as before determined.

By the expression for the strength, $\frac{t\,c}{t + c}$, the strength of different kinds of metal may be readily compared one with another, thus—

	Strength in tension in tons per square inch.	Strength in compression in tons per square inch.
Wrought iron ...	23 ...	12
Cast iron ...	8 ...	51
Copper ...	16 ...	3

If a weight be suspended from the extremity of a metal scantling projecting one inch from a wall, one inch in depth, and one-third of an inch in breadth, the absolute and relative strength of the metal scantling in wrought iron, cast iron, and copper, will be as follows:—

		Absolute Strength.	Relative Strength.
Wrought iron	$\frac{23 \times 12}{23 + 12}$	= 7·8857 ...	100·000
Cast iron	$\frac{8 \times 51}{8 + 51}$	= 6·9152 ...	87·693
Copper	$\frac{16 \times 3}{16 + 3}$	= 2·5263 ...	32·036

Cast iron being 12·307 per cent., and copper 67·964 per cent., weaker than wrought iron. In like manner the strength of timber and other kinds of metal may be found and compared one with another.

In estimating the breaking weight of a beam already broken, reference must of course be had to the *form* and dimensions of the beam, the disposition, tension, and compression of the metal, and from thence, unless shown in the fracture, the position of the neutral axis; the strength, as before found, being the greatest when the neutral axis is at the middle of the depth.

"If a beam be 34 ft. long, 8 ft. deep, and 9½ ft. thick, weighing 42 tons, be loaded with 300 tons at each end, find the strain on each square inch of the top of the vertical central section."

$$\text{By equation (3), strength} = \frac{b\,D\,t\,d'}{3\,l} = W.$$

$$t = \frac{3\,l\,W}{b\,D\,d'} = \frac{3 \times 17 \times 12 \times 310{\cdot}5}{9\tfrac{1}{2} \times 96 \times 48} = 4{\cdot}3408 \text{ tons}$$

per square inch, the tension and compression being the same.

If the tension were 8, and compression 51, then,

$$\text{by equation (2), } d' = \frac{c\,D}{t + c} = \frac{51 \times 96}{59} = 82{\cdot}983.$$

$$t = \frac{3 \times 17 \times 12 \times 310{\cdot}5}{9\tfrac{1}{2} \times 96 \times 82{\cdot}983} = 2{\cdot}5109$$

tons per square inch, the beam being rectangular, and therefore weak in form.

If the tension, compression, and sectional area of the metal in two beams were the same, one rectangular, 9½ × 96 = 912 in., the other flanged, top and bottom flanges (the tension being equal to the compression), 17 in. by 8 in., middle rib 80 in. by 8 in., sectional area 912 in., then, the strength of the rectangular beam will be to the strength of the flanged beam, as 228 to 283, the strength being increased 24·12 per cent. By a proper disposition of the metal, and observing the mechanical rule, "the strength as the stress," the strength of the flanged beam might be further increased.

In two beams, as before shown, suppose the neutral axis to be 48 in. from the top in one beam, 82·983 in. from the top in the other beam, the tension *plus* the compression 59 tons in both beams, then, the flanges being properly proportioned, and all other conditions being the same in both beams, the strength of the beam, neutral axis 48 in. from the top, will be to the strength of the beam, neutral axis 82·983 in. from the top, as 2·133 to 1—which again shows the importance of properly taking into account the tension, compression, position of the neutral axis, and strength of the metal.

I am, Sir, your obedient servant,

WILLIAM LEA, Surveyor.

3, Highgate-place, Birmingham.

Meetings for the Week.

TUES.—*Royal Inst.*, "On Electricity at Rest and in Motion," by Prof. Tyndall, at 3 p.m.

THUR.—*London Inst.*, "Organic Chemistry," by J. D. Wanklyn, Esq., at 7 p.m.

Royal Inst., "On Electricity at Rest and in Motion," by Prof. Tyndall, at 3 p.m.

FRI.—*Architectural Assoc.*, Class of Design—Entrance Gates.

SAT.—*Royal Inst.*, "On Electricity at Rest and in Motion," by Prof. Tyndall, at 3 p.m.

Miscellanea.

Orders were promulgated at Portsmouth dockyard on Thursday for the entry of about 1,000 additional hands, 600 of whom are to be shipwrights, and the remainder of different trades and labourers.

A Frenchman has patented an invention for pulverizing the refuse of slate, and mixing with it some substance which produces a most durable material, and which answers the same purpose as some kinds of our most valuable stone.

An American paper states that a scheme is under consideration for warming houses from a central source, and supplying citizens with heat as gas is now supplied.

The process of manufacturing aluminium in use at Salyndre Works, as described by Mr. A. Stewart, has been published in a recent issue of the *Revue Universelle*. They are working a very valuable ore furnishing pure alumina by two very simple operations, which now renders the preparation of aluminium an actual metallurgical operation in the Ollionelles, near Toulon. Its average composition is—alumina, 60 per cent.; oxide of iron, 25; silica, 3; and water 12 per cent. = 100. After being pulverized under an edge-runner, it is mixed with soda-

and heated in a reverberatory furnace. The mass, although not even agglutinating, becomes changed into an aluminate of soda, and a double silicate of soda and alumina is obtained, mixed with oxide of iron, silica, and a little of the alumina which has not reacted. The aluminate of soda is dissolved out with water (the impurities remaining undissolved), and thrown in fine streams through a current of carbonic acid, by which means alumina is thrown down, and carbonate of soda remains. The precipitated alumina is separated by decantation, and washed with warm water to remove the last traces of soda. In practice no soda is lost, except a small portion converted into silicates, the remainder being recovered by evaporation. The alumina is completely dried, and is ready for final treatment. The manufacture of the sodium has been but little modified. The final reaction which yields the aluminium is effected in a reverberatory furnace. To the double chloride of aluminium and sodium is added about 5 per cent. of sodium; and, lastly, cryolite as a flux. By this means the metallic aluminium is economically and speedily obtained.

The only coal-field in India, of any considerable extent, says the *Mining Journal*, known at present, is that of Raniguni or Damooda, near Burdwan, in Bengal, covering an area of about 500 square miles. There are some 50 collieries in this field, producing yearly on an average about 300,000 tons of coal. The description produced is a variety of non-coking bituminous coal; but one great objection to that worked in the Damooda field is the presence of iron pyrites, and its consequent liability to spontaneous combustion, which render it particularly unfitted for steam ships. The broadest seam yet discovered is at Kasta, where the bed is 35 ft. thick. Next in importance to the Ranigunj field are the Nerbudda coal deposits. They are supposed to extend over an area of fully 300 square miles; but their distance at present from any available market makes the out-turn but of little practical use. As, however, iron ore is found to exist in the same locality, the coal will prove serviceable for smelting purposes, and will thus enhance the value of the iron mines. The best coal is found at a place called Mopani, where the beds have an average thickness of from 7 to 8 ft. A company has already been formed for working these coal and iron deposits, and we have no doubt that, as the railway progresses towards that part of India, the Nerbudda coal fields will afford an ample supply, at a fair profit, to the important line which in two or three years we may hope to see completed as far as Jubbulpore. No workable coal has been found in the Punjaub or north-western provinces; a few patches of lignite only have been met with. In Scinde a small mine was opened in the Lynah Valley, in 1856, by the railway company there; but, owing to its irregularity and probable want of sufficient age, it was abandoned. Neither in the Bombay nor Madras Presidencies, nor in the Nizam's dominions, is coal known to exist; and the few black shales met with on the Godavery, which are incapable of combustion, cannot be said to come under the denomination of coal. The entire quantity supplied annually by the Ranigunj, Rewan, Nerbudda, and other Indian coal-fields, does not exceed 400,000 tons. The Bombay Presidency is now, we believe, undergoing for the first time a geological examination on a systematic scale; but the strata known to prevail over the greater part of its surface precludes the idea of any good or workable coal being found.

An engineering operation of magnitude and importance is projected in the Department of Bouches du Rhone, for the execution of which the Prefect has invited proposals. The object is the formation of a canal to unite the Rhone with the sea. The cost will proably amount to between two and three millions of francs.

The advance in the price of iron has imparted a large amount of activity to the iron trade of South Wales, and all the works of the district are in full employ. Many hundreds of additional hands could be employed at both the iron and coal works, and when the establishments which are about to commence operations are in full work the scarcity of men cannot fail to be more severely felt than at present. Emigration continues, and after every pay-day at the larger works it has become quite an ordinary matter for 30 or 40 skilled hands to leave, the majority of them for the Northern States. The reports of high wages and the succes of connexions and friends are the inducements which influence the men to leave their native country. It is generally believed that the increased demand for iron, the scarcity of workmen, and other circumstances will not only keep prices up, but there is every likelihood that another rise will take place. An increase in the means of supply or over-production is one particular point to be guarded against, or else prices will certainly go down as fast as they have gone up. The following are the number of furnaces in blast and out of blast, at the present time, at the South Wales Works:—Dowlais, in blast 13, out of blast 5; Ebbw Vale, 2, out of blast 2; Victoria, 2, out of blast 2; Sirhowy, 3, out of blast 2; Abersychan, 4, out of blast 2; Beaufort, 6, out of blast 1; Varteg, 1, out of blast 1; Pontypool, 4 (all) in blast; Curnavon, 5, out of blast 2; Golynos, 1, out of blast 3; Cyfarthfa, 11 (all) in blast; Contardawe, 1, out of blast 1. There are several works also at a complete standstill.

The *North British Mail* states that permission to work a French patent for the manufacture of brandy from coal gas has recently been purchased for a large sum by an English company, and the work of manufacture is on the point of being started in London. Coal gas, as many know, is a mixture of several sorts of gases, and olefiant gas, the chief illuminating principle of coal gas, is one of these. The richer, therefore, that any coal gas is in this principle, the better fitted is it for the manufacture of spirits (brandy or whisky). Now, it happens that the coal gas made in Scotland, and in our own city, is among the very best produced anywhere, and accordingly we may expect that this new use will be quickly found for our coal gas, and that possibly the price may come to be enhanced by the circumstance. It is not our purpose to talk of the process, but we may in a word remark that olefiant gas consists of carbon (charcoal) and hydrogen, and alcohol consists of the same ingredients and oxygen. By taking away one-half of the hydrogen of the gas, and adding the proper amount of oxygen, alcohol is formed. The old joke that represented a man who was half-seas over as being "gassed," will not be found far from the truth after all.

From New Zealand we hear of a very important geographical discovery. Martin's Bay, on the west coast of the southern island, had long been known to receive a river flowing from the interior; but the river has now been explored by a Dr. Hector, found to be navigable for a great distance, to be directly connected with a considerable lake, and to bring him by water within forty-six hours' march of Lake Wakitepu. This will open up the interior of the southern island for at least 100 miles, and a settlement on Martin's Bay is very likely to eclipse Dunedin.

An offer has been made to connect the whole of the West India Islands, by telegraph, with the mainland at Cayenne, in French Guiana, and at Key West, near Florida, if a guarantee of 6 per cent. on the outlay can be obtained. The cost is estimated at £300,000.

The last brick of the subway of the new street in Southwark was laid on Thursday by Mr. Thwaites, the chairman of the Metropolitan Board of Works. The ceremony of opening the thoroughfare to public traffic will take place on New Year's Day.

Five of the arches in the new Liverpool Waterworks fell on Monday last, and fearfully, if not fatally, injured a number of the workmen.

It is understood that the Charing-cross Railway will be opened for public traffic on the 1st of January. The station at Charing-cross will probably not be finally completed before March next. The hotel at Charing-cross will not be ready for business until May or June next.

The late extraordinary passage of the "City of New York," Captain Kennedy, has created quite a sensation in nautical circles, and the abstract of her log, which was posted in the Exchange Newsroom at Liverpool, on Tuesday, was a continual source of interest. The distances travelled each day was so great, and withal so regular, that we consider them worthy of being placed before our readers. From the day she left Sandy Hook (the 12th), until noon the following day, she steamed 254 miles; on the 14th, 330 miles; 15th, 320 miles; 16th, 306 miles; 17th, 311 miles; 18th, 321 miles; 19th, 323 miles; 20th, 318 miles; 21st, to Fastnel Rock, 254 miles, arriving at Queenstown at 11.30 in the morning of that day. The mean time of the run from New York to Queenstown is eight days nineteen hours, being the fastest ever made by any screw steamer. Great interest exists as to what time the "Scotia" will be reported off Queenstown; and many confident opinions were expressed that she would arrive there in the course of Thursday (to-day).

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

1221. D. M. Fyfe. *Improvements in the brushes, instruments, or apparatus employed for painting the centres and bulls'-eyes of military or other targets.* Dated May 15, 1863.

For the purposes of this invention, upon a central axis, brushes are mounted on lever arms fixed on the axis, the breadth of each brush corresponding with the radius of the bull's-eye, the circle, and the space intermediate of the bull's-eye and the circle. The central axis is formed with a crank or bow, and with a rest or breast plate at one end, and pointed at the other. An open frame is connected to the central axis, so constructed as to form circular spaces or races corresponding to the surfaces to be painted, within which the movements of the several brushes are controlled in order to confine the action of each brush to the clearly-defined limits of the spaces of this frame. A countersink or recess is punched or formed in the centre of the bull's eye, and when it is desired to paint or repaint the central portions of the target (the brushes above referred to having been first supplied with paint of the colour required for each section) the point of the central axis is placed in the central hole or recess in the bull's-eye, with the open frame and brushes resting against the face of the target; the central axis is then caused to revolve by means of the crank or bow, and the several sections of the target upon which the brushes are thus caused to operate will be readily covered with paint. *Patent abandoned.*

1222. D. M. Fyfe. *Improvements in the means or apparatus employed for raising, removing, transporting, and refixing military or other targets or mantlets.* Dated May 15, 1863.

The object of this invention is to obviate the difficulty, danger, and loss of time incurred in raising, removing, transporting, and refixing heavy military or other targets and mantlets. For this purpose the patentee constructs a carriage frame of suitable strength, mounted on two or other suitable number of wheels, with shafts or other means of draught, and to the hinder part of this frame the bed or platform for supporting and carrying the target or mantlet is hinged or joined, in such manner as to be capable of being tilted or raised into a vertical position, and lowered again by suitable mechanical means. Upon the frame of the carriage a shaft or axis is mounted, and turns in suitable bearings, and on this shaft or axis one or more toothed pinions (or it may be a worm wheel) are fixed, the teeth of which engage with one or more toothed sectors fixed on the under side of the moveable bar or platform of the carriage. One or both ends of the axis of the pinions may be suitably formed for receiving the socket of a winch handle, by turning which motion is given to the pinion and to the toothed sectors, and by this means the moveable bed or platform of the carriage will be raised from its horizontal into a vertical position against the face of a target or mantlet which is to be raised and removed. To the sides and upper end of the moveable bed or platform hooks, clips, or holdfasts are attached capable of being readily caused to embrace the outer edges or flanges of the target or mantlet, so as to secure it firmly to the bed or platform. When this is accomplished, motion is again imparted to the axis, pinions, and toothed sectors, and the target or mantlet will thus be raised upon the bed or platform, which is then caused to reassume its horizontal position upon the frame of the carriage ready to be removed or transported to any other desired site. Suitable break apparatus may be applied to the pinion, axis, and to the wheels of the carriage. *Patent completed.*

1223. W. Clark. *Improvements in repeating firearms.* (A communication.) Dated May 15, 1863.

This invention relates to repeating firearms which are loaded at the breech from a magazine composed of a tube arranged below and parallel with the barrel, the said magazine containing the cartridges arranged end to end one behind another. The cartridges employed are of the kind known as fixed ammunition—that is to say, they have metallic shells, and carry their own fulminate priming; and they are carried up from the mouth of the magazine to a position in rear of the barrel by means of what is termed a carrier block working vertically within a mortise in the frame of the arm, and are afterwards pushed into the barrel by means of a sliding breech-pin, the said carrier-block and breech-pin being both operated by means of a lever arranged under the stock. The first part of the invention consists in the employment, in combination with such sliding breech-pin, of a plunger which passes through the said breech-pin, and moves with it, but which has a certain amount of longitudinal motion independent of such pin for the purpose of effecting the explosion of the fulminate priming by the blow of the hammer upon it. The second part of the invention consists in the combination with the so applied breech-pin and plunger of a rest for the support of the cartridges at the bottom, and a spring catch for taking hold of them at the top to withdraw the empty shells from the chamber of the barrel after their discharge. And the third part of the invention consists in so forming the top of the above-mentioned carrier-block that, in its rise from the mouth of the magazine to present a new cartridge in the rear of the barrel, it will strike the last discharged and withdrawn cartridge shell in such manner as to throw up the front end of the same, while its rear end is held down by the spring catch to the breech-pin end, and so to tip it over in a backward direction, and free it from the catch, and throw it out of the firearm. *Patent completed.*

1224. A. Macmillan. *Improvements in buttons, and in fastening buttons to garments.* Dated May 15, 1863.

For the purposes of this invention, in constructing buttons, whether of metal or other materials, and whether covered or not, the patentee forms each button with a stem or shank at the back, by preference of a cylindrical shape; at the back end of the stem or shank is formed an enlargement of somewhat greater diameter than the stem or shank, but still such as will pass through a comparatively small hole in the fabric to which the button is attached; and in order to assist in retaining the stem or shank from being drawn back through the hole when the button is in use, a disc of leather, vulcanized india rubber, or other suitable material, is employed; through this disc a small hole is made, the enlarged end of the stem or shank of the button is forced through it, and the disc by its elasticity embraces the stem or shank. *Patent completed.*

1225. R. T. Mallett. *Improvements in the construction of piers, walls, and other similar structures, and of landing stages, and in the constructions therewith or attachments thereto.* Dated May 15, 1863.

The patentee claims—1, the general system or mode of constructing piers, walls, and other similar solid or hollow structures, substantially in the manner described and illustrated in the drawings; 2, the application and use of the peculiar construction of continuous undersunk coffer dams, composed of iron or other metal, in combination or not with other materials, in the building of piers, embankment, walls, and similar structures, substantially in the manner described; 3, the constructing of iron or other metal coffer dams for piers, walls, and similar structures in sections of single thickness, bolted together, as described; 4, the application and use of water-tight compartments, diaphragms, or bulkheads of iron or masonry, in combination or not with other materials, between the surface of the structure and the interior of the coffer dam, substantially in the manner described; 5, the application and use in combination with the water-tight partitions, diaphragms, or bulkheads above referred to, of plates made adjustable to suit the surface of the wall or other structure, in the manner described; 6, the application and use in combination with the water-tight partitions, diaphragms, or bulkheads above referred to, of a flap of vulcanized india rubber, or other suitable material, in combination or not with adjustable plates, for the purpose of obtaining a water-tight joint, as described; 7, the system or mode of moving floating landing stages or dummies by means of their approaches only, as described; 8, the peculiar construction and arrangement of the steps or surfaces of the approaches to floating landing stages or dummies, as described. *Patent completed.*

1226. J. Patterson. *Improvements in machinery or apparatus for grinding, crushing, cleaning, and hulling or shelling various kinds of farm or vegetable produce, also applicable to the crushing or grinding of minerals and other substances.* Dated May 15, 1863.

This invention relates to that class of mills in which the grain or other substance is introduced through an eye or aperture in or near the centre of one of the stones to the space between the grinding surfaces, and is ground or otherwise operated upon in its course from thence to the periphery where it is discharged. The grinders may be of stone or steel, or other suitable material, and may be placed horizontally or vertically. They may also be placed concentrically or eccentrically to each other. The improvements consist—1, in causing both the grinders to revolve in the same direction, but at different speeds, to facilitate the discharge of the ground material, and to effect a more perfect distribution of the feed over the grinding surfaces; 2, in place of imparting to both stones a simple rotary motion on their axes, it is proposed, in certain cases, to impart a compound or twofold motion to one of them by causing it to revolve round its own axis, whilst at the same time such axis itself is made to describe an orbit round an imaginary axis. By this compound motion of one of the stones a wrenching or compound action is obtained upon the substances to be ground, or otherwise acted upon, in addition to the effect produced by the ordinary motion of millstones or other similarly arranged grinding surfaces. 3, of an improved mode of introducing the substance to be ground or otherwise acted upon between the grinding surfaces. For this purpose a recess or space is formed in the back of the stone around the spindle upon which it revolves, and as close, up to the surface of the stone as convenient, and from this recess the grain or other substance to be ground or otherwise acted upon is thrown through several surrounding openings by centrifugal force. The admission of the grain or feed is regulated by a modification of the apparatus known as the "silent feeder." The sliding-tube in this case encloses the mill spindle, and is sufficiently large to allow the grain to pass freely towards the end of the tube, from which it is allowed to escape, as the tube is drawn back from the inner end of the recess. 4, in causing both stones to revolve upon the same spindle, by fixing one of them upon the spindle and the other upon a tube which encloses a portion of the spindle, and is free to revolve upon it. 5, in an improved mode of regulating the distance between the grinding surfaces by connecting a screw on the spindle by means of wheelwork with a handle and wheel or regulator in such a way that the handle or wheel remains at rest while the spindle revolves. *Patent completed.*

1227. J. Papin, C. Lintz, and L. Lavacherie. *Improvements in the manufacture of boots and shoes.* Dated May 8, 1863.

This invention consists in prolonging the ordinary upper leather of the boot or shoe in such a manner as to form a sole and make by itself a supporter for the application of the other soles for repairs. Instead of using the small pieces of leather which in the old system form the filling up, the inventors employ a single piece of good leather which forms the sole, and is inserted into and at the same level with the prolonged upper leather. It is upon that sole, formed by the prolonged upper leather and the filling piece, that the double sole and the last sole are sewed or nailed. *Patent abandoned.*

1228. R. W., W., and T. Waddington. *Improvements in combs for combing wool by machinery.* Dated May 16, 1863.

This invention relates to improvements in the combs used in wool-combing machines, known and distinguished as Rawson's machine, in which a circular comb is employed. The object of this invention is to dispense with the backing operation, or the necessity for combing wool several times over, as practised in Rawson's machine aforesaid, and to enable the combing to be accomplished effectually at one operation. *Patent abandoned.*

1229. B. Browne. *Improvements in the manufacture of elastic material.* (A communication.) Dated May 16, 1863.

In carrying out this invention the patentee forms a die or plate with holes or indentations therein, so that the elastic material in the act of being made into sheets will have on its under side a series of points or projections. The material thus formed may be applied between the soles of boots and shoes when in use, when the weight of the body and pressure of the feet of the wearer will compress the series of points aforesaid, and produce elasticity, very much resembling that furnished by nature in the structure of the human foot. Material of the above form, when applied to the manufacture of horse collars, saddles, knapsacks, and such like articles, may be so affixed as to admit of the free passage of air between the materials, thus rendering them self-ventilating, and by thus distributing the pressure or weight on the saddle, collar, and knapsack, chafing is avoided, and the weight carried with more comfort and ease than when the above-named articles are made in the manner heretofore practised. *Patent completed.*

1230. J. Hincks. *Improvements in lamps.* Dated May 16, 1863.

These improvements are especially applicable to night lights or lamps in which volatile hydrocarbons are burned, but are also applicable to other lamps. In applying this invention to a night light or lamp, the patentee employs a flat wick, which is raised and lowered in its case in the ordinary way. In conjunction with the said flat wick he uses a deflector, having a circular opening for the flame to pass through, instead of the flat or elliptical opening ordinarily employed. He perforates the windguard with large and numerous perforations, so that there is a copious supply of air through the windguard to the under side of the deflector. The advantages obtained by these improvements are, that the length of the flame remains constant or nearly constant during a long burning of the lamp, a shorter chimney may be employed than that required in lamps of the ordinary construction, and the combustion of the oil is so perfect that it burns without odour. *Patent completed.*

1231. R. Talbot. *A folding rudder for steering barges in the river Thames or coastwise.* Dated May 16, 1863.

This invention consists in dividing the rudder in two parts, the outer part of which is caused to fold into the inner part or box, so as to shorten or reduce the length when requisite. *Patent completed.*

1232. F. M. Burns. *Improvements in preventing the fouling of the bottoms and sides of ships and vessels, particularly applicable to ships and vessels constructed of, or sheathed with, iron.* Dated May 16, 1863.

In carrying out this invention, a tank or receptacle for oil or other oleaginous substances is fitted in any convenient part of the vessel; or if iron masts be used, their interiors may be made available for containing the oil or oleaginous substances. From this tank or receptacle a pipe leads, or pipes lead, to pipes or channels on each side of the keel, or at each side of the out-water or otherwise, such channels or pipes being perforated with numerous small holes, through which holes the oil shall ooze out, and thence ascend and keep the sides and bottom well greased, which will effectually prevent the adhesion of barnacles and other marine animals and plants. Before leaving the dry dock, the inventor proposes to oil or grease the sides and bottom of the vessel. When applied to wooden ships, iron sheathing could be used with the arrangements above described, thereby obviating the necessity of using copper or other expensive sheathing. *Patent abandoned.*

1233. W. Clark. *Improvements in rotary engines.* (A communication.) Dated May 16, 1863.

This invention is not described apart from the drawings. *Patent abandoned.*

1234. J. T. Newton. *Improvements in machinery for planishing and rolling sheet metal.* Dated May 16, 1863.

According to this invention, the patentee obviates the difficulties which have hitherto prevented the use of pairs of planishing rollers of small size, by putting such a pair of rollers between two other rollers, by preference, of larger size; the axes of all the rollers are in the same plane, and the outer rollers are capable of being set up towards each other in the usual manner. By this arrangement it will be seen that, when a plate is passed between the pair of small planishing rollers, they are prevented from yielding by the outer rollers which support them throughout their whole length, and as the two small planishing rollers constantly run in contact with the outer rollers, they are ground true by them as fast as they are worn away by the plates, hence they will run for a considerable time without re-turning. *Patent completed.*

1235. J. Gibbs. *Improvements in preparing and spinning flax and other vegetable fibres and filaments, and in machinery employed therein.* Dated May 16, 1863.

This invention is not fully described apart from the drawings. *Patent completed.*

1236. W. White. *Improvements in machinery or apparatus employed in the dressing of lace or other fabrics.* Dated May 16, 1863.

The first part of this invention relates to the circular or roundabout machine of that kind in which the needle bits are moved up and down vertically in saw gates formed in an upper and a lower ring. These rings are usually made of brass; but the patentee prefers to make the upper ring of wrought iron fitted rather tightly on the inner cylinder, but so as to be capable of sliding vertically upon it, and of being at the same time carried round with it, without sliding upon it horizontally. The second part of this invention relates to the straight machine. Here the crank moves a bar which has as many drivers attached to it as there are divisions in the machine; each driver may be thrown out of gear from the bar which it drives, so that one or more breadths of work may be made at the same time, as one or more of the divisions in the machine is or are at rest; or the whole may be moved together, each bar moved by a driver causing the whole of the movements requisite to produce a looped fabric. *Patent completed.*

1237. T. O. Stretton. *Improvements in machinery or apparatus employed in dressing of lace or other fabrics.* Dated May 16, 1863.

In carrying out this invention, the patentee employs two rails which lie parallel to and over the two side rails of a dressing frame and are provided at each end with a swivel frame or bearing, each bearing carrying two pulleys or rollers which run upon the upper side of the rails of the dressing frame. Each of these bearings also carries a roller which bears against the outside of the rails. In the part of the bearings above the first-named rails a provision is made to allow of two other rails sliding within the bearings, one end of each of the two last-named rails is attached to the swivel of the bearings, and the other end of the rails slides in the other two bearings, so that as the dressing frame is narrowed or widened, the two first-named rails will be upon the rails of the dressing frame. Running upon the upper pair of rails is a pair of trucks which support a frame carrying a box or trough, to one side of which a number of stop-cocks are secured. The other end of the stop-cocks is attached to the outer one of two pipes lying one within the other. There is a cap at one end of the outer pipe which unscrews, so that the interior of the pipe may be readily washed out. The other end of the pipe has a cap attached to the inner pipe, so that the inner pipe may be turned round to regulate the flow of the starch or other "dressing" liquid placed in the trough or box above named. The outer pipe is pierced with holes through which the "dressing" flows on to a strip of flannel or other suitable material, whence it drips on to a roller which is nearly of the same width as is the distance between the upper rails. This roller is capable of being raised by a lever at either end or at both ends. When a piece of lace or other fabric has been supplied with the dressing liquid for the same length as the width of the roller, the rails and apparatus are then moved to the extent of the length so dressed, and the next length of lace or other fabric is then dressed. The roller, trough, and perforated pipe, with their appliances, are moved from side to side of the dressing frame by a handle attached to the apparatus. *Patent abandoned.*

1238. E. B. Wilson. *Improvements in the manufacture of iron and other metals, and in the apparatus employed therein.* Dated May 16, 1863.

This invention consists in a novel form of vessel and mode of treatment, by means of which the patentee is enabled to reduce, deoxidate, and purify metalliferous sands, ores, and metals, especially iron, and further to purify them and remove the various impurities, and to produce the metal pure; or to carbonify or convert iron into steel when it is under operation. The patentee effects this by dividing the vessel into two chambers by means of a diaphragm properly arranged for the purpose. The upper and larger chamber is used for reducing purposes, and this portion he calls the reducing chamber. In this the ore, metallic sands, pig iron, or other metal, with the necessary reducing agents and materials, are placed, and a blast of heated gases and atmospheric air is blown upon the materials from above until the metal is reduced to a liquid. He assists the down-blast by means of a jet or jets of steam for reasons hereafter to be described. In some cases the metals may be placed in the bottom of the chamber, and reduced by the

gases without charging the metal with the fuel. The metal, when reduced, descends into the lower portion of the reducing chamber, and passes through the diaphragm, which is supplied for this purpose with convenient perforations or passages, to allow both metal and heated gases free conduct to the lower or refining chamber. The refining chamber is of a convenient shape, and the metals being there collected, are therein exposed to the action of the flames and heated gases passing from above upon them; or if desirable, a further supply of gases or air may be blown through the side of the refining chamber upon or through the metal therein. The gases, after completing their work, are allowed to escape by any convenient exit, which may be provided with a regulator or damper, so as to regulate the current or draught. This refining chamber may also be provided with suitable inlets, so that materials or gases capable of carbonizing the metal may be injected. The reducing chamber may be provided with a manipulating door, to examine or test the iron or metal under operation, and with suitable arrangements for charging and discharging the materials. The other purposes to which this invention is applicable are such as the manufacture of glass. *Patent completed.*

1239. J. WHITEHEAD. *Improvements in motive power machinery, especially adapted for raising and forcing water and other liquids or fluids, part of said improvements being applicable to steam engines and other machines fitted with pistons.* Dated May 16, 1863.

The object of this invention is to dispense with the necessity for employing stuffing boxes in hydraulic machines, steam engines, and other machines working with pistons, and thereby to avoid or reduce friction at such parts. The patentee proposes to effect this by the following means:—The piston, plunger, or ram he forms less in diameter than the bore of the cylinder in which it works, and to the bottom of each ram he affixes a piece or pieces of leather as a tube of semicircular form inside its lower or outer edge. Inside the tube, and on a rod screwed into the bottom of the said piston or ram, he places loosely a spherical or conical-shaped piece of metal, which, when pressed against by the water, forces the edge of the leather outwards, and causes the same to fit the cylinder water-tight. He proposes to form the cylinder of a solid square piece of metal, bored out at its centre, and open at top (having no stuffing box) to receive the rams. The cylinders are fitted in an oblong cistern containing water. Two or more small pumps fitted with suitable valves are also fitted in the cistern, and the pumps are worked by cranks or eccentrics mounted on a shaft for injecting water into the square cylinders aforesaid for lifting the rams and imparting motion to a long lever, an anti-friction roller being adapted to the head of the rams upon which said lever rests. This lever has its fulcrum on a strong pin fixed in a standard, and the end of this lever is connected to the pump rod leading down the shaft of the mine, pit, or other place from which the water is to be raised; or the power may be transmitted by pulleys and bands, or spur or bevel gearing, to the machinery to be driven. In adapting the piston above described to the cylinders of steam engines, he proposes to use a band of steel, or other suitable metal, instead of leather. *Patent completed.*

1240. E. CHRISTMAS. *Improvements in carriages for common roads.* Dated May 18, 1863.

The patentee claims the use and application of a bottom side plate formed of flanged or angle iron, as described, and the substitution thereof—especially in the doorways—for the timber and timber-plated bottom sides and framing as at present used; 2, the inside door suspended and supported platform and recess construction of carriage for invalids, as described; 3, the lever and other mechanism for raising and lowering the platform and actuating the other improved parts as described. *Patent completed.*

1241. W. WATSON. *Improvements in the manufacture of bread, and an apparatus used for the same.* Dated May 18, 1863.

We cannot here give space to the detail of this invention. *Patent completed.*

1242. H. BENNETT. *Improved apparatus or mechanism to be used for facilitating the puddling of iron.* Dated May 18, 1863.

This invention consists in applying mechanism worked by steam or other power to assist the puddler in the process of puddling. The patentee accomplishes this as follows:—He has a shaft to work horizontally, endways or backwards and forwards, similar to the piston rod of an engine. This shaft can be extended to several furnaces, and to this shaft he connects a connecting rod moving a sliding piece backwards and forwards in a slide, and connected with which sliding piece he has a vertical shaft, at the top of which the puddler's rabble or tool should rest, so as to participate in the motion of the vertical shaft. This vertical shaft can be moved round to different angles by means of a ratchet motion (or mechanical equivalent) so that the puddler can guide the motion of the rabble to different parts of the furnace. By this invention a puddler will be able to work with ease a larger quantity of iron in each charge, thus effecting a saving of fuel and time. *Patent completed.*

1243. A. HEATHER and J. REDFERN. *Improvements in the construction of steam boilers for marine, locomotive, and stationary engines.* Dated May 18, 1863.

This invention has reference to a previous patent, dated February 23, 1860 (No. 495). The first improvement relates to the tube plate referred to in the specification of the patent of 1860, and consists in forming the tube plate situate at the front of the boiler angular or curved towards the side flues, instead of flat or square with the said side flues. This improvement is designed for the purpose of increasing the draught in the flues of multitubular boilers. The second improvement consists in constructing multitubular boilers with a central flue extending from back to front of the boiler. These improvements it is proposed to use with the other parts of the boiler as described and represented by the specification and drawings of the aforesaid patent. *Patent completed.*

1244. B. HEBBLEWHITE. *Improvements in machinery or mills for crushing or reducing oil cake, seeds, and other substances.* Dated May 18, 1863.

This machinery consists of a frame carrying toothed rollers between which the substance to be reduced is first passed in order that it may enter another part of the machinery, which the inventor terms a pulverizer, in pieces of such size that the pulverizer will not be liable to become choked. A hopper conducts the substance after being acted upon by the reducing rollers into the pulverizer, which consists of a closed cylinder, the inner surface of which is toothed; an axis carrying toothed arms is fitted inside the cylinder, and the outlet from the cylinder is covered or lined with wire gauze or with perforated plate. The toothed arms are made to revolve rapidly, and the substance fed in from the reducing rollers is projected against the interior surface of the cylinder, and, becoming pulverized, is driven out, when sufficiently fine, through the wire gauze or perforated plate. *Patent abandoned.*

1245. R. FENNER and W. H. HIGHT. *Improvements in envelope-folding machines.* Dated May 18, 1863.

This invention consists in arranging the parts of envelope-folding machines as follows:—The patentees attach a plunger to an arm working from a centre, which plunger works in and out of a creasing box. In the creasing box is a series of slides, which, at the proper time, run in and give the correct inclination to the flaps of the envelope. At the bottom of the creasing box is another plunger working upon a similar arm. The two arms with their respective plungers are actuated by cams on the main shaft, and the stamping is performed by a lever also worked by a cam on the main shaft. *Patent completed.*

1246. S. TOY. *Improvements in machinery for making screw rivets, nails, or pins.* Dated May 18, 1863.

This invention consists in such improvements of the machine that the inventor is enabled to produce two or more rivets, nails, or pins at one revolution of the machine. He constructs the frame and nearly all the working parts of the machine precisely as they are now built; but he employs two or more sets of cutters actuated simultaneously by the same levers, using a corresponding number of set pins. He also employs a corresponding number of dies for pressing the nails, and all worked from one lever. The cutters and dies are all fixed upon one plate of a suitable form to receive them. He also employs two or more punches to head the rivets, nails, or pins. These punches are fixed on a slide formed to suit the different centres of the several dies and cutters, the heading, when heads are required, and cutting off, being performed at one revolution of the machine. *Patent abandoned.*

1247. J. BEAUMONT. *Improvements in condensing machines for working yarns of wool and other fibrous substances.* Dated May 18, 1863.

This invention has for its object to increase the fineness of the slubbing, roving, or yarn, without diminishing the quantity of work produced on the condenser, thereby effecting a considerable economy in the manufacture. This is effected by passing the slubbing between a series of pairs of rollers and rubbers in which certain of the rollers act as bottom rollers and rubbers, and the other articles act as top rollers and rubbers. Both bottom and top rollers act as drawing rollers, and, therefore, the fibres or slubbing will be rubbed between these rollers in the process of drawing. As these rollers work one over the other, the fibres or yarn in the form of a slubbing will be drawn between them, and at the same time will undergo the process of rubbing by means of the same rollers, to which an ordinary reciprocating motion in the direction of their axis will be communicated while they are rotating on their axis. These rollers are rotated by means of toothed wheels and pinions actuated by a driving wheel connected with the doffing cylinder, the toothed wheels and pinions being of such diameter and number of teeth, and so arranged with reference to each other, that a progressively increasing rotary motion may be communicated thereto. *Patent completed.*

1248. C. BARNARD, J. BISHOP, C. BARNARD, jun., and G. BARNARD. *Improvements in lawn-mowing and rolling machines.* Dated May 19, 1863.

In constructing lawn-mowing machines in which two drums are employed, the patentees make the drums loose and free to revolve on the drum shaft, and fix two ratchet wheels (or other equivalent contrivance) fast on the shaft. These ratchet wheels are acted on by pawls attached to the drums in such manner that, when the machine is moved forward, the drum shaft revolves; but when the machine is drawn backward, the drum shaft remains stationary. By this arrangement the levers hitherto used for engaging or disengaging the drum from its shaft, are entirely dispensed with. An ordinary ratchet and spring pawl may be used; but they prefer to make the pawls silent in their action, for which purpose they attach to them a spring embracing the shaft, so that when the machine is moved forwards, the pawl is brought into contact with the ratchet wheel, and retained there, but when the machine is drawn backward, the pawls are lifted and kept out of contact with the teeth until the forward motion is recommenced, when the the pawls again come into action. To communicate motion from the drum shaft to the spiral cutters, they employ a friction wheel on the drum shaft acting upon an intermediate friction wheel (having by preference an india rubber periphery), to which there is attached a similar wheel, but of a different diameter; these wheels are carried on a stud fixed in a radial arm attached to the side frame of the machine on the drum side, and free to move up and down, and in the direction of its length, in order that it may adjust itself between the wheel on the drum shaft and a small friction pinion on the shaft which carries the cutters. They enclose this gearing in a suitable case to protect it from dirt or injury. *Patent completed.*

1249. S. RHODES. *Improvements in machinery for twisting and doubling cotton, hemp, flax, and other like fibrous materials.* Dated May 19, 1863.

This invention relates, chiefly, to the manufacture of twine and strong cord, and consists in giving a more regular twist to the strands or yarns composing the cord, and preventing what is termed in the trade "riding of strands," making the twisting distance as short as possible, that is, the distance between the flyer and the point of junction of the strands. *Patent completed.*

1250. J. EDWARDS. *Improvements in the permanent way of railways.* Dated May 19, 1863.

In carrying out this invention, the inventor fits suitable iron arms to the sides of the rails; these arms are fitted by means of bolts and nuts, or bolts and cotters. The bolts he sometimes makes hollow to get extra strength, and these bolts he applies to fasten fish plates and other parts of the permanent way. Under the arms he places a wood or other sleeper, the sleepers passing between the stay and arms, which hold them in position under the rail. He passes a brace or stay, which is fixed to the ends of the arms by bolts and nuts or otherwise, under the rail, and inside the brace he places a filling piece of any suitable material. When he uses iron sleepers which are made of angle iron cut to length, he prefers to make the sleepers answer the purpose of fish plates and sleepers combined. These sleepers he sometimes forms by carrying a thin plate of metal from arm to arm, and so saves metal. For the arms he uses T-iron with holes perforated to get the bolts in; but he does not confine himself to this plan, as the arms can be formed in many ways. Tie bars of wood or metal are passed under and bolted to the sleepers; also he applies a capping to the rails, which capping is rolled to fit the head of the rails, and is either bolted, sprung, or forced on. This capping takes the wear off the rails; and it is only requisite to renew the capping instead of the whole of the rail. *Patent abandoned.*

1251. J. H. JOHNSON. *Improvements in breech-loading firearms.* (A communication.) Dated May 19, 1863.

This invention relates to that class of breech-loading firearms in which metallic cartridges are used, whether such firearms be constructed as revolvers, carbines, rifles, or pistols, and consists in the application and use to and in repeating firearms of a cylinder or revolving charge chamber made shorter than the cartridge-case to be used therewith, and having a compound back and forward as well as a rotary motion imparted thereto, in combination with the lock, so that the lock and cylinder will slide together in a recess or recesses in the stock, which stock is permanently connected with the barrel of the firearm. The trigger in the arrangement above referred to is permanently connected with the stock, and cannot therefore be used until the lock and cylinder are slid into their proper breech-closing position. A lock-case is also employed for enclosing and protecting the lock, and serving as a guide for the cylinder whilst sliding to and from the barrel. The cartridge is fired by the percussion of a pin situate within the lock-case above referred to, such pin being acted on by the hammer of the lock when the arm is to be fired. The sliding motion of the cylinder in the recess in the stock is obtained from a lever working on a pivot at its rear end, and connected by a link with the rear end of the lock-case, whilst the rotary motion of the cylinder is simultaneously produced by a pawl and lever acting on a ratchet wheel on the base of the cylinder, and caused to operate by being drawn over a fixed stud pin in the stock, the under side of the lever being inclined or cam-shaped, so as to impart the motion required to the cylinder as it passes over the fixed stud pin. *Patent completed.*

1252. F. FENTON. *Improvements in the treatment of certain vegetable fibres for the preparation of textile materials therefrom.* Dated May 19, 1863.

This invention relates to the preparing and softening of the fibres of tallee ramee, urtica tenacissima, China grass, Assam grass, Japan hemp and flax, Shanghai hemp, and Italian hemp, with a view to the removal therefrom of the gummy and resinous matter, and to effect the perfect separation of the fasciculæ of fibres, whereby they are rendered applicable to the manufacture of fine textile fabrics, being spun either alone as long or short fibres, or mixed with wool or cotton. *Patent completed.*

1253. R. BUNTING. *Improvements in frames, tips, and bolsters used in cutlery, and in securing handles therein or thereto.* Dated May 19, 1863.

This invention consists in constructing the frames for knife handles of metal with the opening or openings for receiving a scale of ivory or other material formed with inclined sides and ends, so as to constitute a smaller aperture on the outside than on the inside of the frame. The patentee then inclines the sides and ends of the ivory or other scale to be inserted in the frame to correspond with the inclines in the sides of the aperture in the frame, and thus secures the scale from getting out of the frame. Or where the scale to be inserted is capable of being rendered plastic, he runs or presses it into the frame from the inside. Two frames are united to constitute one handle. *Patent completed.*

1254. H. J. OLDING. *Improvements in treating flax and other fibrous plants in order to prepare the fibres thereof for spinning.* Dated May 19, 1863.

Here the patentee takes the flax or other fibrous plant in a green state, or in any other condition, and after the [illegible] has been separated, he proceeds as follows:—For gre[illegible] he passes it through a machine formed with two pairs of rollers or cylinders, the surface of whic[illegible] formed with a series of diagonal intersecting [illegible] presents the flax or other fibrous plant wit[illegible] parallel with the axis of the rollers, and pass[illegible] them in that position. The action of the roller[illegible] the boon without injury to the fibres. Whe[illegible] dry, he passes it in the ordinary manner [illegible] rollers and between other rollers having a [illegible] jogging as well as rotary motion, whereby m[illegible] bruised by the first rollers is shaken out by [illegible] plant is now ready for the next part of the [illegible] consists in steeping the plants in vats or [illegible] with covers to be used or not according [illegible] The vats are charged with a liquor, [illegible]

impregnated with lime, sulphur, and manganese, or either or any two of these materials. The plant is allowed to steep in this liquor for an hour or two, more or less. The plant is then subjected to a similar liquor, but of such strength only as to reduce leaves of turnips, swedes, or other like leaves which are placed therein to a pulpy state, and to precipitate the colouring matter to the bottom. The plant is afterwards removed and subjected to a stream of clear water. The liquor and dissolved portion of the plant issues from the vat through a valve or cock, and runs into a pool or other receiver. After the washing, he takes the fibres and dries them by any ordinary means, or by passing them through two or more pairs of rollers, and subjecting them to the action of reels or fans constructed of hollow tubes acting alternately on the fibres, and made to drive warm or heated air into and among the fibres, whereby the fibres are finally dried, separated, and freed from boon and foreign matters. *Patent completed.*

1255. J. KELLY. *Improvements in the treatment of peat or turf, and the manufacture thereof into charcoal and other fuel.* Dated May 19, 1863.

We cannot here give space to the details of this invention. *Patent abandoned.*

1256. A. PARKER. *An improved apparatus for saving from destruction by fire persons and property in houses, buildings, and ships, and also for ventilating ships.* (A communication.) Dated May 19, 1863.

In carrying out this invention, as applied to houses and buildings, the patentee fixes in a suitable position gun barrel or other tubing or piping, varying in size as may be requisite, according to the size of the building, such tubing or piping bending through the wall where necessary, and being carried up to the roof and along the tie beam to the kingpost from one end of the roof to the other, such tubing being plain, and stopped at the ends with screw-stop ends. From this tubing or piping branches of plain pipe are to proceed from the kingpost up the struts, and from thence to branch off and be fixed to the purlins, which pipe is to be perforated with three or four rows of holes in a zig-zag direction, being one on each side going from end to end of the roof; each end of this pipe is to have perforated bends screwed to the same, and brought across and connected with the pipes opposite, which are also to be perforated. If the roof is small, one perforated pipe in the centre will be sufficient. In public buildings or places of worship with galleries of one or more tiers, pipes should descend through the ceiling, and turn round the cornice on the outside of the flowers or centre pieces, and be perforated with three or four rows of holes, leaving two or more inlets from the large pipe above. Branches of plain pipe are to be connected with the main pipe in the roof, and to descend through the ceiling, and be attached to perforated pipes fixed above the gallery on the ceiling. This pipe may be classed as a member of the cornice or branched across to the outside of the gallery, playing its water upon the body of the building or gallery. The pipes for quenching the fire in the staircases should be connected by branches with the pipe above, and be fixed on the wall above the staircase, and be perforated as above described. A small ring of perforated tubing fixed on the ceiling with the water brought from above is sufficient to thoroughly saturate a room in a few seconds. Stop cocks are to be placed in the different parts of this apparastus so as to prevent a waste of water where it is not required, but these cocks should always be left open in case of emergency. Force pumps should be fixed in a suitable position, and connected with the main ascending pipe or tubing, to force the water through it. Domestic water-tanks, placed high in the building worked by valves and connected with the plain pipe in the roof, may be made available for the supply of water to the perforated pipes or tubing in the lower parts of the building; or the supply may be had from the public water main, which should be connected with the ascending pipe on the wall, or where the same may be fixed. *Patent completed.*

1257. L. CHANDOR. *An improved mechanical lamp.* Dated May 19, 1863.

This invention relates to a novel construction of lamp in which volatile hydro-carbons are burned, and consists in suppling air to the wick by mechanical means. To this end a fan or ventilator is mounted in the interior of the lamp, and rotary motion is communicated thereto by means of a strong spring and clockwork. *Patent abandoned.*

1258. T. P. SALT. *Improvements in the manufacture of trusses.* Dated May 19, 1863.

This invention consists—1, in forming the spring in trusses used for inguinal hernia in two parts, the one sliding on the other, so that the spring may be extended or contracted in front, the two parts of the spring being secured together by binding screws. The sliding end of the spring is curved upwards and outwards, the exact curve being adopted which conforms most nearly to the the line of the abdomen, and would bring the pads directly over the inguinal openings. The opposite end of the spring which presses on the spinal column is provided with two revolving circular pads instead of one, thus preventing any inclination to tilt or work out of the horizontal line. The pads are attached to the front part of the truss by a small hook-shaped spring, one limb of which is connected by binding and adjusting screws to the front part of the truss, and the other limb secured by a central screw upon which the pads rotate. 2, The invention refers to improvements in the manufacture of pads for all descriptions of trusses, and it consists in forming such pads of thin shells or blanks of metal, horn, or other suitable material, and covering such blanks with material of any required description, in manner similar to that in which Florentine buttons are made. The blanks when not formed of metal may be edged with it to afford the means of securing the covering; and for the purpose of obtaining a soft surface or cushion on the face of the pad between the covering and the shell, the patentee places spongio-piline, or other suitable stuffing. He thus dispenses with all sewing, and obtains a light and strong pad with an even surface. *Patent completed.*

1259. L. CHANDOR. *An improvement in lamps.* Dated May 19, 1863.

The object of this invention is to improve that class of lamps in which kerosene or volatile liquid hydrocarcons are burned. The improvement consists in adapting to the lamp a tube of sheet metal, or other suitable material open at both ends, and of somewhat greater diameter than the wick tube. The lower end of this tube is placed at or near the top of the wick tube, and its upper end extends above the wick tube so as to encircle the lower part of the frame. By means of this heated tube the atmospheric air will be continually consumed and replaced by fresh atmospheric air, the oxygen of which by mingling with the escaping gases of the flame (which are mostly carbon compounds) will produce a more perfect combustion. A short tube is placed around the top of the wick tube, and is attached to the holder which supports the metal air-heating tube above mentioned, so that, by merely raising or depressing the upper or air-heating tube, the light may be increased or diminished at pleasure. The metal air-heating tube first mentioned is attached to the holder by a hinge, spring, or any similar contrivance, so that the metal tube may be conveniently turned on one side to permit of the lamp wick being trimmed. *Patent abandoned.*

1260. W. SMITH. *Improvements in transferring plain or coloured prints or designs to wood or other surfaces.* Dated May 19, 1863.

This invention relates to a new mode of transferring coloured or plain prints or designs to and upon dark, variegated, or light-coloured wood, or other surfaces, and consists in covering all parts of the print or design over with opaque white colour, made up with oil and varnish, and then pursuing any of the usual modes of transferring. *Patent abandoned.*

1261. H. WREN and J. HOPKINSON. *Improvements in the construction of self-lubricating bearings for shafts and axles.* Dated May 20, 1863.

This invention relates to the kind of lubricator for which letters patent were granted unto Adolph Mohler, dated February 2, 1854 (No. 261), and consists in a mode of ensuring a more copious and regular distribution of oil over the upper surface of the shaft or axle. For this purpose the patentees employ a plate or projection supported by the upper part of the plummer block or bearing, and the said projection or plate arrests the course of the oil brought up from the reservoir by the collar, and causes it to flow upon the working surface of the neck. *Patent completed.*

1262. J. COIGNARD. *Certain improvements in sewing machines.* Dated May 20, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1263. W. J. C. LANG. *Improvements in the manufacture of certain articles to be used for preserving life at sea and other purposes.* Dated May 20, 1863.

In carrying out this invention, the inventor constructs carpet bags, and other bags used for travelling purposes, when made wholly or in part of flexible material, with one or more air-proof chambers made wholly or in part of flexible air-proof material. These chambers, or the chamber when one only is employed, may be filled with air at convenience for the purpose of a life preserver, suitable valves being employed for the ingress and egress of the air. The air-proof chambers may be affixed to the sides or bottom of the bag, or may form the division itself that is generally used in carpet bags. *Patent abandoned.*

1264. P. ADDINGTON. *Improvements in the manufacture of varnishes.* Dated May 20, 1863.

This invention consists in the construction of varnishes applicable to the uses of railway and other carriage builders, house decorators, paper stainers, enamellers, oiled baize and leather or varnished cloth makers, and all or any other purposes to which gum or resinous varnishes are ordinarily applied, to be as follows:—The patentee proposes to manufacture the said varnishes by the following method, viz., by fusing gums, resins, or resinous gums, viz.:—gum amber, gum copal, gum amine, gum damar, gum kowrie, gum resin, gum asphaltum, in proportion as follows: gum, 80 lbs.; oil, 20 gallons; petroleum, 20 gallons, in copper, iron, or plated vessels, at a temperature varying from 400 deg. to 700 deg. Fahr. The gums or resins being in a state of fusion, the patentee introduces or mixes clarified oils, viz., either linseed, nut, poppy, or sunflower oil, the gum or resin and oil being mixed or combined. The patentee employs as a vehicle rock oil or petroleum spirit, either crude or the rectified petroleum of commerce, or crude petroleum refined in a certain manner, instead of spirits or oil of turpentine. *Patent completed.*

1265. R. R. JACKSON and W. PEMBERTON. *Improvements in looms for weaving.* Dated May 20, 1863.

This invention relates to a system or mode of putting strain or tension upon the yarn or warp in looms for weaving, and it consists in the application of frictional arrangements to the yarn or warp itself, instead of applying friction to the axis of the warp beam; or it consists in the combination of friction and weight applied to the yarn directly, or to the apparatus acting upon the yarn; or it consists in causing the yarn from the beam to pass over an edge or rod, then under a roller covered with elastic material, then over another edge or rod, and then on to the healds. *Patent abandoned.*

1266. T. WILLIAMS and I. NAYLOR. *Improvements in paper spools or tubes used in spinning and doubling machines.* Dated May 20, 1863.

According to the present invention, each paper tube has affixed all round one end a projecting flange. These spools are placed on bobbins which are put on the spindles of spinning or doubling machines, and have yarns or doubled yarns wound thereon, but in place of the cops being wound conical at each end, as has heretofore been the case in winding a yarn or a doubled yarn on to a paper tube, the winding at that end where the flange is formed or applied may extend to a diameter as large as the flange, whilst the winding at the other end will be conical, as before, when using paper tubes without flanges. By these means a paper spool or tube may be made to contain a much larger quantity of yarn or of doubled yarn than heretofore. *Patent abandoned.*

1267. J. C. MARKALL. *Improvements in machinery for the working of wood.* Dated May 20, 1863.

We cannot here give space to the details of this invention. *Patent completed.*

1268. J. CASSELL. *Improvements in the treatment of mineral oils and hydro-carbons.* (A communication.) Dated May 21, 1863.

This invention is carried out as follows:—After the mineral oils and hydro-carbons have been, in preference, first heated with sulphuric acid and alkali in the usual way, the inventor introduces them into a still, heated by the naked fire, or by superheated steam, and adds to them from 1 to 10 per cent. (the quantity depending upon the nature of the oil to be treated) of a mixture composed of the bichromate of potash and caustic soda, in preference, in the following proportions:—one part of bichromate of potash and two parts of caustic soda, at 36 degrees. He then distils them. Potash may be substituted for soda; and instead of bichromate of potash and caustic alkalies, he applies any of the salts of chromium, alone or in combination with the alkalies, caustic, or otherwise, although he prefers those stated above. After this distillation the oils may be treated as before with sulphuric acid and water. *Patent completed.*

1269. G. R. HARDING. *Improvements in the means of transmitting power on railways worked by vacuum or the pressure of air.* Dated May 21, 1863.

The patentee claims—1, the improvements set forth in the valve or means of transmitting power on railways worked by vacuum, and the form and mode of connecting the parts of the apparatus employed for such purpose, as set forth; 2, the use or employment of blocks or pieces of material having sides angular or converging towards each other, for the purpose of fitting into a V-shaped trough, and having also in relation to the longitudinal axis of the tube and the trough in which the blocks are fitted angular faces or fitting and bearing surfaces, by which the greater the atmospheric pressure or the better the vacuum the more perfect contact is ensured between the working parts of the apparatus; 3, the construction of flexible bars or valves, as described, for closing the communication between the external atmosphere and the interior of the tube of an atmospheric railway. *Patent completed.*

1270. W. WALKER. *Certain improvements in looms for weaving.* Dated May 21, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1271. J. STEART. *Extracting the fibre from zostera marina and other aquatic vegetable productions.* Dated May 21, 1863.

In carrying out this invention, the inventor submits the plant or weed to various degrees of pressure, by means of rollers or otherwise, for the purposes of bruising or loosening the outer sheath or skin and the saccharine matter. He then places it in a wash bath of fresh cold water, for the purpose of removing all external impurities. It is then treated in a bath being a preparation of fish and water, or other animal extract, denominated a pure bath, at a high temperature, for a suitable length of time; and lastly, to pressure and friction, while in the pure bath, at the same temperature. By this process the outer sheath or skin of the plant or weed is decomposed and removed, leaving the fibre in an uninjured state. It is then dried and cleansed, and fit for manufacturing purposes. *Patent abandoned.*

1272. W. NUNN. *Improvements in the construction of signal lanterns or lamps.* Dated May 21, 1863.

The patentee claims—1, the combination of the anchor or uncoloured lantern or lamp in its complete and perfect form, as ordinarily employed, with a shell or casing containing coloured glasses, through which its light may be shown when required, substantially as described; 2, the construction of a lantern or lamp to answer the combined purposes of anchor and sailing lantern or lamp, in which combined lantern or lamp the usual uncoloured lantern or lamp constituting the anchor light in its complete and perfect form, as usually employed, is (when the whole combined lantern or lamp is required to be made use of for sailing purposes) passed into or partly into and partly outside of the shell or casing containing the coloured glass or glasses, so that the light contained within such anchor lantern or lamp may be shown or displayed through such coloured glass or glasses, and that the entire combined lantern or lamp may, when in that position, occupy a proportionately diminished space, substantially as described; 3, the use or employment of glasses or lenses double convex in vertical section, and constituting an entire or continuous circle or segment, or segments of such circle, in plan, and having each horizontal section of such circle or segment or segments parallel or of equal thickness throughout; 4, the use or employment of flat and segmental burners having a central space, whereby air is admitted upward to the inner side of the wick in the same manner as, or nearly in a similar manner to, that usual with the ordinary circular argand burner, substantially as described. *Patent completed.*

1273. F. P. WARREN. *Improvements in attaching copper or other sheathing to iron vessels.* Dated May 21, 1863.

For the purposes of this invention, the patentee first covers the parts of the vessel to be sheathed with a coating of fibrous or other non-conducting material, in order to insulate the iron of the vessel, or which may be attached thereto, or connected therewith, from the metal or composition of metals constituting the sheathing. In order to attach this coating of fibrous or other non-conducting material, he prefers, firstly, to roughen the surface of the iron, either by milling or otherwise, so as to increase the holding effect of the adhesive material or composition employed for holding or attaching the non-conducting material to the

vessel, and which may consist either of pitch or any other suitable substance or composition. A second coating of fibrous or other non-conducting material may then, if required, be similarly attached by adhesive material to the sheathing plates intended to be applied to the vessel, the inner surfaces of such plates having been first roughened by milling or otherwise to increase the adhesion of the non-conducting material to them. In proceeding to apply the plates of sheathing, beginning at the upper row thereof, he drills the plates intended to be joined together near to their edges with corresponding rows of holes, and successively attaches them to each other upon the coating of non-conducting material attached to the vessel, by means of the split or bent nail or rivet hereinafter described, the plates of sheathing being successively attached to the coating referred to by means of any suitable adhesive substance. The form of the nails or rivets employed is such as to cause them, on being passed through the holes drilled or punched around the edges of the plates and driven home, to become (on coming in contact with the non-conducting material attached to the vessel) turned out or clenched so as to hold the plates firmly together. *Patent completed.*

1274. E. T. Hughes. *Improvements in breech-loading firearms, and in cartridges connected with the same.* (A communication.) Dated May 21, 1863.

These improvements relate to firearms to be loaded at the breech, for which purpose the inventor unites the barrel or barrels solidly to the breech by means of screws, wedges, or other appropriate means; and at the rear of the barrel, and in a line with the same, he places a rocking conduit or feeder hung on a centre placed below the said conduit, and capable of assuming two different positions. The first is for the purpose of loading, in which case the end nearest the barrel is tilted downwards, its lower surface on which the cartridge rests presenting itself thus in one continuous line with the bore of the barrel, so that the cartridge can be easily pushed from the conduit into the barrel. The second is for receiving the force of the explosion, in which case the end nearest the barrel is raised sufficiently to close completely the aperture of the barrel, and thus offer effective resistance at the moment of the explosion. Another improvement relates to the construction of the lock, which consists in a tumbler provided with a hammer or needle placed below the barrel, and which can be cocked by a motion of the finger, and discharged by a trigger in the usual manner, the hammer or needle penetrating through a small aperture in the under side of the barrel to enable it to reach the fulminate of the cartridge. The main spring actuating this tumbler is also placed under the barrel, and in a line with the same. Another improvement consists in a cartridge containing fulminate powder, ball, and wad, built on a central stem or core, one extremity of which is fixed to the projectile, whilst the other extremity is provided with a small protruding metallic tube charged with fulminating powder, the explosion of which effected, the hammer above mentioned causes the ignition of the charge of powder which is placed round the said central stem or core, and covered externally with paper, linen, or other appropriate material. *Patent abandoned.*

1275. N. J. Amies. *Improvements in the manufacture of elastic webbing.* Dated, May 21, 1863.

This invention consists in the employment and use of a tape, band, or flat length of india rubber, instead of a number of strands, and in covering such flat length with silk, worsted, cotton, or other fibrous materials, by means of a circular braiding machine, this being a more economical method. *Patent completed.*

1276. A. Thomalley. *Improvements in brick kilns.* Dated May 21, 1863.

According to this invention, it is proposed to construct the kiln with a number of flues which convey the smoke and sulphurous vapours to a tall chimney built at any convenient distance from the kiln. In some cases, two or more kilns may be combined with one chimney, so that when one kiln is burnt out, the waste heat may be passed through the other, which has in the mean time been made ready for firing, thus preparing and drying the bricks before burning. This invention may be readily applied to an ordinary brick kiln, by having a flue or flues built upon the top of the kiln, and communicating by lateral flues with each other, a descending flue at the side or one end of the kiln receiving the smoke and vapours from the top flues, and carrying them off to a tall chimney. *Patent abandoned.*

1277. W. H. Clapp. *Improvements in rails or holder for coats, &c.* Dated May 21, 1863.

For the purposes of this invention, the patentee employs two brackets, by preference of metal, made to resemble ordinary hat pegs, and they have at their ends notches. In conjunction with these brackets, a rail is employed, by preference made of wood, but with metal fittings at the ends. These end fittings each consist of two discs or flanges with, between them, a piece shaped to fit the notches in the ends of the brackets. The outermost disc is not fixed, but screws on to a stem projecting from the innermost disc. The coat or other article to be held is folded and placed over the rail; this is then put into its place on the brackets, the ends of the brackets entering between the flanges at each end of the rail, and as the rail at these parts fits the ends of the brackets, it is held securely so that it cannot turn, otherwise the coat or article might run off. The rail can be secured by screwing up the two outer discs, so as to clip the ends of the brackets, and for convenience their screws are made right and left handed, so that to secure the rail they may both be required to turn the same way, either towards or from the person using the article. The rail may also be held on suitable supports formed on the brackets near their root, or where they spring from the wall or partition, and the brackets can then be used as hat pegs. The screw discs cannot come off the stems, as these are rivetted over to retain them. *Patent completed.*

1278. E. Sonstadt. *Improvements in the manufacture and purification of the metal magnesium.* Dated May 21, 1863.

The peculiarities of this apparatus and process of distillation of metallic magnesium are, that the apparatus is made of iron, and is closed air-tight during the distilling process; that the air is excluded by filling the apparatus with hydrogen before the commencement of the distillation; and that the second vessel or receiver is placed immediately beneath the fire bars of the furnace which heats the first vessel, or that which contains the crude metal, so that this second vessel may, when required, be heated sufficiently to keep the magnesium which distils over in a fused or liquid state: and so that the pipe connecting the two vessels may be kept sufficiently hot to prevent the condensation of magnesium in it. *Patent completed.*

1279. J. Fawcett. *Improvements in the preparation of food for cattle, horses, &c.* Dated May 21, 1863.

This invention relates to an improved method of preparing vegetable material for provender or food for horses, cattle, sheep, or pigs, by cooking such substances in a steam apparatus, and preparing the same for pressing into loaves, blocks, or cakes, or for grinding, mixing, and for granulating, so as to be specially adapted for horse corn to be used instead of crushed oats and beams. *Patent completed.*

1280. J. Goodman. *Improvements in velocipedes, and in the construction of wheels for the same and other carriages.* Dated May 21, 1863.

These improvements in velocipedes consist in connecting treadles and hand levers to the cranked axle to which the main wheels of the carriage are fixed, and in arranging handles to the hand levers, which, through chains or cords, communicate with the fore carriage in which the guide wheel is fitted, and turn it in any direction required for guiding the carriage. The improvements also consist in mounting the axle of the guide wheel in a groove or slot made in or applied to the sides of the fore carriage. The improvements in wheels consist in the following arrangements. The patentee introduces the outer ends of the spokes in the felloe (where felloes are used), or direcly in the tyre. He forms the hub or nave in two parts—one consisting of a ring, collar, or flange, carrying an inclined ring, which is inserted under the inner ends of the spokes, and of an outer ring or flange. The driving in of the inclined or conical ring, tightens up the spokes, and the parts of the nave are secured by screws or bolts. *Patent completed.*

1281. R. A. Brooman. *Improvements in breech-loading ordnance, breech-loading and other arms.* (A communication.) Dated May 21, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1282. W. Snell. *Improvements in butt hinges.* (A communication.) Dated May 22, 1863.

This invention is not described apart from the drawings. *Patent completed.*

1283. C. Maschwitz. *Improvements in stoppers or bungs for closing or stopping bottles, jars, &c.* (A communication.) Dated May 22, 1863.

This invention consists in making stoppers or bungs for closing or stopping bottles, jars, and other vessels, and the muzzles of rifles, and for other like purposes, capable of being made to contract and expand in diameter in that part of the stopper or bung which fits into the opening to be closed. *Patent abandoned.*

1284. T. A. Blakely. *Improvements in ordnance.* Dated May 22, 1863.

This invention consists in constructing cannon and other ordnance of an inner tube or barrel of brass, bronze, or other suitable alloy of copper, with a jacket of steel. This jacket may be in one or more pieces, or may be composed of a series of separate hoops. The invention further consists in forming the barrels of two or more tubes, an inner tube of mild steel, with the outer tube or tubes of harder steel, the steel being increased in hardness the farther it is removed from the centre. In some cases the outer tubes are in the form of rings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated September 10, 1863.

2230. T. B. Jordon, Milton Cottage, South Lambeth, mechanical engineer. Improvements in granulating and drying gunpowder, and in apparatus to be used therefor.

Dated October 8, 1863.

2470. J. Mead, Abridge, Essex. Improvements in the construction of various articles of furniture.

Dated October 19, 1863.

2554. W. Fletcher, Gloucester, gunmaker. Improvements in the construction of breech-loading firearms.

Dated November 4, 1863.

2734. M. Luneau, 60, Boulevart de Strasbourg, Paris, military collar manufacturer. Improvements in the manufacture of hat or cap frames.

Dated November 11, 1863.

2799. J. Smith, Cheetham, Manchester, dyer and finisher. Improvements in machinery for finishing or beetling woven fabrics, which improvements are also applicable to fulling machines.

Dated November 12, 1863.

2814. J., J., and J. Booth, Rodley, near Leeds, engineers and copartners. Improvements in guy cranes and other similar cranes.

2820. D. Ford, Islington, engineer. Improvements in propelling boats and barges.

Dated November 14, 1863.

2840. H. Gladstone, 2, Butler's-terrace, Ossory-road, Old Kent-road, cartridge manufacturer. Improvements in the manufacture of skin cartridges.

Dated November 16, 1863.

2892. E. C. Nicholson, Fenchurch-street, manufacturing chemist. Improvements in the manufacture of colouring matters suitable for dyeing and printing.

Dated November 19, 1863.

2896. W. B. Adams, Holly Mount, Hampstead, engineer. Improvements in wheels, tyres, axles, and axle boxes, and modes of applying them.

2897. J. Eglin, Glasgow, engineer. Improvements in "drifts," and in apparatus for making the same.

2902. W. H. Gray, St. Austell's, Cornwall, engineer. Improvements in the construction of blast cylinders, and also in the form and method of working the valves of the same.

Dated November 20, 1863.

2917. C. Stevens, 31, Charing-cross. An improved hoisting and lowering apparatus. (A communication.)

2925. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the means of, and instruments for, attaching tags or labels to bales or packages of merchandize. (A communication.)

Dated November 23, 1863.

2943. C. Howard, 23, Stanley-terrace, Deptford. An improved watch case pendant, applicable also to other articles.

Dated November 27, 1863.

2978. J. A. R. Main, 5, Renfield-street, Glasgow, gentleman. Improvements in the mode of connecting and sustaining the intersecting bars of iron fences, hurdles, gates, and other analogous structures.

Dated December 2, 1863.

3022. R. Lublinski, 183 and 185, City-road, stick manufacturer. A new method of bending the reverse ends of partridge canes, and bending partridge canes without roots.

3024. T. Snook, 25, Wilson-street, Stockport-road, Manchester. An improved apparatus for causing a stronger and better draught or current of air so that house fires may be lighted or kindled in a very short space of time, for effecting a very considerable saving in fuel, and for throwing the heat from such fire into the building or room.

3025. J. Dales, New-inn, Strand, engineer. Improvements in fitting moveable or travelling frames and surfaces.

3026. J. Capper, Waterloo, near Liverpool, accountant. Improved apparatus for curing smoky chimneys, and preventing down draughts therein.

3028. T. T. England, Colne, Lancashire, cotton spinner. Improvements in lubricating the shafts of the conducting pulleys of mules, which improvements are also applicable to machinery in general.

3029. H. Holdrege, engineer, Irvington, United States. Improvements in the process and manner of making gas for illuminating, heating, and other purposes, a part of which may also be applied to the production of metallic oxides. (A communication.)

3030. S. Trotman, 11, Albert-street, Camden-town, engineer. Improvements in the manufacture of soap.

3034. T. Harrison, Tudhoe, near Ferry-hill, Durham, mechanical engineer. Improvements in machinery for cutting coal and other minerals and stones.

3035. H. D. P. Cunningham, Bury, Alverstoke, esquire. Improvements in reefing and furling topsails, topgallant sails, and royals.

3036. C. Langley, Deptford, shipbuilder. Improvements in the construction of ships of war and other vessels.

3038. C. Cammell, Sheffield, steel manufacturer, and W. Crompton, Openshaw, mechanic and smith. Improved railway crossings adapted to the ordinary single or double headed rails.

Dated December 3, 1863.

3043. E. Stevens, 4, Warwick-villas, Canonbury. Improvements in apparatus used when cooking.

Dated December 4, 1863.

3047. R. Riley, Sharples, near Bolton, manager. Certain improvements in carding engines.

3051. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in working railway brakes. (A communication.)

3053. T. Douglas, South Audley-street, Grosvenor-square. Improvements in the construction of combs for the human hair.

Dated December 5, 1863.

3057. W. Gorman and J. Paton, Glasgow. Improvements in obtaining and applying heat, and in apparatus therefor, being also in part applicable for lighting.

3063. J. A. Wanklyn, London Institution, Finsbury, chemist. Improvements in the production and manufacture of certain yellow and orange colours. (A communication.)

Dated December 7, 1863.

3065. A. J. Aspinall, Tue-Brook, near Liverpool. An improved hand stamp or seal for marking or impressing consecutive numbers or figures.

3067. A. Antill and W. Wilkinson, Birmingham, jewellers. An improved mode of manufacturing joints and catches for brooches and other articles of jewellery.

3069. F. Piercy, Glenadon-house, Dockmouth, Devon, artist. Improvements in the application of heat to water and other fluids, and in apparatus for the same.

3071. M. Turnor, Birmingham, metallic pen manufacturer. Improvements in pencil cases and holders for crayons and other marking, writing, or drawing materials, and in boxes for holding leads for pencils, crayons, and other articles.

3077. C. Brown, Leicester, mechanic. An improved manufacture of elastic bands, applicable to the production of ladies' skirts or crinolines.

Dated December 8, 1863.

3079. W. Wanklyn, Albion Mills, Bury, cotton spinner. Improvements in the construction of machinery for ginning cotton.

3081. J. H. Brierley, Beech Hill Mills, Halifax. Improvements in buckles for brace and other dress fastenings.

3087. T. A. Blakely, Montpelier-square, late captain Royal Artillery. Improvements in projectiles for ordnance, and in loading and firing ordnance.

3089. P. H. Desvignes, Lewisham, gentleman. Improvements in apparatus for exhibiting dissolving views.

3091. H. Eastwood, Elland, machine maker, and B.

Matthews, mechanic. Improvements in machinery or apparatus for carding wool or other fibrous substances.

3095. W. McIntyre Cranston, 77, Upper Thames-street. Improvements in reaping and mowing machines. (A communication.)

3099. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in the mode of, and apparatus for, preparing cork stuffing for mattresses, pillows, cushions, and other articles, and in the mode of applying the cork stuffing thereto. (A communication.)

Dated December 9, 1863.

3101. H. Audinwood, Weston-upon-Trent, Derbyshire, engineer. Improvements in raising or removing grain from one place to another.

3105. J. Wright, Dudley, Worcestershire, engineer. Improvements in furnaces, fire-grates, and fire-bars.

3107. T. V. Morgan, Battersea Works, crucible manufacturer. Improvements in the treatment and purification of plumbago for the manufacture of crucibles, and other fireproof articles, and in apparatus employed therein.

3109. M. Hillary, Andover, contractor. Improvements in fastenings for doors.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated December 9, 1863.

3103. W. H. Cole, 52, Gracechurch-street, merchant. Firstly, for casting steam cylinders of steam engines in the form of a segment of a cylindrical ring or circle; and secondly, for the machine for boring them truly cylindrical, and retaining the line of the bore on the curve of a true circle. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, December 22, 1863.

1977. D. W. Barker. Shuttle boxes.
1978. J. T. King. Distributing gas.
1979. W. B. Haigh. Saw-frame.
1985. Sir J. S. Lillie. Revolving battery.
1990. R. Canham. Moulds for casting.
1992. R. S. Newall. Drying chemical compounds.
1993. R. Wappenstein. Preventing forgery of bankers' cheques.
1994. W. Hudson, C. Catlow, and J. Dodgeon. Looms.
1995. R. S. Newall. Serving ropes for ships' rigging.
2000. J. Edmunds. Gun and pistol furniture.
2018. W. Asbury. Axles and axle boxes.
2021. G. Yates. Apparatus for indicating quantities of coal or other material drawn from mines.
2027. F. Flavell. Shakers for thrashing machines.
2029. T. Brooks. Charcoal.
2035. A. W. Parker. Soap.
2043. J. S. Crosland. Lubricating.
2054. J. B. V. Faure. Pen and ink holders.
2058. C. Sonnhammer. Fan.
2078. R. A. Brooman. Expressing and filtering oil from seeds and liquids. (A communication.)
2085. A. Watson. Inserting pictures in photographic albums.
2086. R. A. Brooman. New metallic alloy. (A communication.)
2097. H. F. McKillop. Cleansing ships' bottoms.
2122. G. Davies. Iron and steel. (A communication.)
2124. J. Shaw. Cutting turnips.
2222. W. Clark. Utilizing refuse azoted matters of commerce. (A communication.)
2315. T. Richardson, J. Lundy, and R. Irvine. Oils.
2330. H. Hutchinson. Moulded articles of india rubber. (A communication.)
2371. J. Spence. Plastic composition.
2836. W. B. Adams. Wheels, tyres, &c.
2920. G. S. Kirkman. Railway carriages and trucks.
3010. E. A. Inglefield. Working guns.
3034. T. Harrison. Cutting coal.
3035. H. D. P. Cunningham. Reefing and furling topsails.
3047. R. Riley. Carding engines.
3057. W. Gorman and J. Paton. Obtaining and applying heat.
3103. W. H. Cole. Casting steam cylinders of steam engines. (A communication.)

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed December 17, 1863.

1514. J. Banwell.
1516. J. Newnam.
1523. W. Naylor.
1524. J. A. Sparling.
1525. J. L. Gaune.
1536. H. A. Bonneville.
1545. D. D. Kyle.
1547. R. Brownlee.
1550. C. Peterson.
1562. E. Wilks.
1563. A. Twaddell.
1567. L. A. Majolier.
1608. A. Tulpin.
1609. W. Clark.
1614. T. Dunn.
1639. J. H. Johnson.
1654. W. E. Newton.
1659. H. S. Warner.
1663. J. McDonald.
1672. A. and B. S. Gower.
1680. G. C. Collyer.
1721. M. A. F. Mennons.
1734. M. W. Ruthven.
1902. J. H. Johnson.
1568. W. Rowan.
1575. J. Murray.
1576. A. R. Stocker.
1580. T. F. Parsons.
1588. W. Toovey.
1592. E. Myers and W. R. Williams.
1603. W. Kirrage.
1605. H. C. Lee.
2039. H. A. Bonneville.
2352. T. and W. Marshall.
2459. J. Gibson.
2472. A. V. Newton.
2477. G. Parry.
2549. E. H. C. Monckton.
2593. R. Baillie.
2661. J. Marshall.

Sealed December 21, 1863.

1578. W. W. Sleigh.
1581. R. A. Brooman.
1590. T. Redwood.
1591. P. R. Hodge.
1595. T. Skinner.
1600. T. Page.
1601. J. O. Mathieu.
1604. H. G. Craig.
1606. A. Watson.
1610. G. Boccius.
1615. G. Clark.
1618. J. Chatterton.
1620. W. Andrews.
1621. C. Avery.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3035. G. Davies.
3086. G. Davies.
3088. A. Kinder.
3092. N. C. Szerelmey.
3194. T. Gibson and W. and H. Knighton.
3039. A. Verwey.
3101. T. W. Walker.
3128. T. and B. C. Sykes.
3146. E. Cook and J. Stokes.
3132. G. B. Rennie.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2993. G. M. P. Swift, Viscount Carlingford.
3002. C. Fay.
3003. J. Brown.
3015. T. White.

LIST OF SPECIFICATIONS PUBLISHED.

For the Week ending December 19, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.		Pr. s. d.
846	1 2	920	0 10	929	0 8	938	1 4	951	0 4		0 10
878	0 6	921	3 2	930	0 8	939	0 4	952	0 10	962	0 4
879	0 8	922	1 0	931	0 8	940	0 4	953	0 8		0 4
881	0 6	923	1 0	932	1 0	941	0 8	954	0 4	963	0 6
884	0 10	924	3 6	933	0 4	942	0 10	955	0 4	964	0 4
885	0 8	925	1 0	934	0 4	944	0 4	956	0 4	965	0 4
895	0 6	926	0 4	935	0 6	948	0 8	957	0 4	967	0 4
899	0 10	927	0 10	936	0 10	949	0 4	958	0 4	968	0 4
918	0 4	928	0 4	937	1 0	950	0 8	959	0 8	969	0 4
919	0 4										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	pr ct
IRON:—					
Welsh Bars, in London	per ton	7 15 0	to	8 0 0	2½
Nail Rods	do	8 5 0		8 15 0	
Hoops	do	10 10 0		11 0 0	
Sheets, single	do	£11 10 0		12 0 0	
Staffordshire Bars	do	9 10 0		10 0 0	
Bars, in Wales	do	7 0 0		7 10 0	
Rails	do	7 0 0		0 0 0	
Foundry Pigs, at Glasg. No 1	do	3 5 0		3 7 0	
Swedish Bars	do	12 0 0		12 10 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		17 0 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	105 0 0		0 0 0	
Hammered Bottoms	do	115 0 0		0 0 0	
Flat Bottoms, not Hamrd	do	110 0 0		0 0 0	
Tough Cake and Ingot	do	98 0 0		0 0 0	
Tile Copper	do	98 0 0		0 0 0	
Best Selected	do	101 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 9		0 0 9¼	
Fine Foreign	per ton	100 0 0		102 0 0	
TIN:—					
English Block	per cwt.	5 12 0		0 0 0	2½
do Bar	do	5 13 0		0 0 0	
do Refined	do	5 17 0		0 0 0	
Banca	do	5 16 0		5 17 0	nett
Straits	do	5 13 0		5 15 6	
SPELTER:—					
On the spot	do	18 15 0		0 0 0	nett
ZINC:—					
English Sheet	do	24 10 0		26 0 0	2½
QUICKSILVER	per btl.	7 0 0		0 0 0	3
REGULUS OF ANTIMONY:—					
French star	per ton	33 0 0		0 0 0	2½

TIMBER, duty 1s. per load, drawback 1s.

Teak	load £12 0	£13 0		
Quebec, red pine	3 10	4 10		
" yellow pine	3 10	4 10		
St. John, N.B. yellow	0 0	0 0		
Quebec oak, white	5 10	6 10		
" birch	3 10	4 10		
" elm	3 10	[illegible]		
Dantzic oak	3 10	[illegible]		
" fir	3 10	[illegible]		
Archangel, yellow	£13 0	13 10		
St. Petersburgh, yel.	11 10	12 0		
Finlan	9 0	10 0		
Memel	10 0	15 0		
Gothenburg, yellow	10 0	11 0		
" white	9 0	9 10		
Gefle, yellow	10 10	11 10		
Soderhamn	9 10	10 10		
Christiania, per C.,				

Memel fir	3 5	3 10
Riga	3 0	3 5
Swedish	2 10	2 15
Masts, Quebec red pine	5 0	6 0
" yellow pine	5 0	6 0
Lathwood, Dantzic, fm	6 10	6 10
" St. Petersburg	8 0	8 10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.		
Quebec, white spruce	15 10	18 10
St. John, white spruce	14 0	15 10
Yellow pine, per reduced C.		
Canada, 1st qual.	17 0	18 0
" 2nd do.	11 0	12 0
12ft. by 3 by 9 in.		
Christiania, yellow	21 0	23 0
Deck Plank, Dantzic, per 40 ft. 3 in.	0 11	1 0
PUMICE STONE per ton	5 10	0 0
OILS, &c.		
Seal, pale ...per tun	47 10	0 0
Sperm body	76 0	7[illegible]
Cod	54 0	[illegible]
Whale, Sth Sea, pale	45 0	[illegible]
Olive, Gallipoli	58 0	6[illegible] 11
Cocoanut, Cochin	46 10	47 0
Palm, fine	36 0	3[illegible] 10
Linseed	34 0	0 0
Rapeseed, Eng. pale	39 10	0 0
Cottonseed	33 0	34 0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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